BU BME Department

Graduate Student Handbook for PhD Candidates

Fall 2017

College of Engineering Satisfactory Academic Progress Requirement for PhD Students

The College of Engineering is committed to five full years of financial support for graduate students in the College of Engineering PhD program who maintain **Satisfactory Academic Progress**. This support will be in the form of Teaching Fellowships, Doctoral Research Fellowships (formerly RA's) or Graduate Fellowships. Funding beyond five years is generally provided (but not guaranteed) to students who are working productively toward the PhD degree. The following achievements are required to maintain Satisfactory Academic Progress:

- Students must complete the required coursework with a B average (GPA of 3.0) or better and pass the PhD oral qualifier exam within the allotted time frames. Thereafter they will need to complete a Prospectus and a Dissertation.

- Students are required to find a research home and funding no later than 12 months after beginning the program. The preponderance of the funding arises from extramural sources such as fellowships, training grants and research funding from grants of individual faculty. Once securing a funded research home, the department guarantees continued funding through the fifth year. Typically this funding will derive from extramural sources. If bridge resources are required from the department, the department can require that the student be a teaching fellow for the time they are being supported.

The inability to find a faculty research supervisor willing to serve as a research supervisor by the end of 12 months and with funding is initially interpreted as not making satisfactory progress toward the PhD degree. In rare cases, after the first 12 months a student is able to identify a faculty willing to serve as a research supervisor but neither the faculty nor the student is able secure extramural funding for the second year. This student can petition and request one additional year of funding from departmental resources. Such a request will need to convey to the Chair that the student has found a research advisor willing to supervise the student and that the advisor and/or student have a concrete plan to secure extramural funding sources following the additional year. Decisions to support this request are at the discretion of the department Chair. If no such funding has emerged after the second year, these students will be deemed as not making satisfactory academic progress and they may not be permitted to complete their PhD studies.

After joining a laboratory in accordance with the conditions above, students register for research credits each semester and summer they work in that laboratory. If the supervisor feels the student is not making satisfactory progress, the supervisor will provide a four month warning letter (equivalent to a semester or summer). If the progress remains unsatisfactory, the faculty will dismiss the student from their laboratory. The student must then either find an alternative funding source from an individual faculty member or leave the program. After dismissal, the student has one summer or academic semester to find alternative support. During this period, the department is under no obligation to find support for the student but may choose to do so, at the discretion of the department/program leadership.

Any egregious violation of academic or research ethics may result in immediate dismissal from the program at any stage with no opportunity for re-admission.

College of Engineering Graduate Student Academic Standards Policy

Academic Standards

The academic progress of every graduate student is reviewed at the end of each semester. Failure to make satisfactory progress and remain in **Good Standing** can result in **Academic Probation**, **Suspension** for a stated time or until stated conditions are met, or **Dismissal**, as detailed below.

Grades of C+ or lower for PhD students are interpreted as failures.

Good Standing
Students maintain **Good Academic Standing** when they: (1) earn a semester GPA of at least 3.0 (students enrolled only in Pass/Fail courses are exempt from the semester GPA standard); and (2) maintain a cumulative GPA of at least 3.0.

Academic Probation
A student is put on **Academic Probation** when s/he earns a semester or cumulative GPA below 3.0. Students on Academic Probation may have their financial aid discontinued. In the event that the semester or cumulative GPA is below a 2.0, a student may be dismissed from the program.

Students are reviewed after one semester on Academic Probation. Those who earn a semester and cumulative GPA of 3.0 or above will return to **Good Standing**. Those students who do not achieve Good Standing (as defined above) after the probationary semester will be subject to **Academic Suspension**, **Dismissal**, or an additional semester of **Academic Probation** as determined by the College on a case-by-case basis.

Academic Suspension
A student on Academic Probation faces Academic Suspension or Dismissal when s/he has not achieved **Good Standing** (as defined above) after the most recent semester of Academic Probation. Specifics regarding **Dismissa**l or the duration and terms of the **Academic Suspension** will be determined by the College on a case-by-case basis. Dismissal results in permanent separation from the University. Appeals of **Dismissa**l or **Suspension** are directed to the Associate Dean for Academic Programs.

Reinstatement after Academic Suspension
Students who have fulfilled their period of **Academic Suspension** must meet with their academic advisor and must also reestablish their standing in the College by contacting the College of Engineering Graduate Programs Office (enggrad@bu.edu; 617-353-9760).

College of Engineering GPA Requirement for Awarding Graduate Degrees

Doctoral students must complete all degree program requirements and earn a cumulative grade point average of at least 3.0 to be awarded a degree. The cumulative grade point average includes all coursework taken after matriculation and all courses completed prior to matriculation submitted in fulfillment of degree requirements.

Auditing Courses
An auditor is a student who attends a class to acquire knowledge but not to earn credits or a grade. Audited courses do not count toward completing degree requirements. An auditor may not change his or her status after the fifth week of classes for standard courses. Auditors must attend classes regularly, complete assigned reading, and participate in discussions, but they are excused from examinations.

Auditors are admitted to a course on a space-available basis and with the approval of the instructor. Auditors are subject to the full tuition and fees of the course.

PhD students who have completed all departmental course requirements are entitled to audit officially one course each semester, excluding Summer Term, without further tuition charge. Students may not audit ENG 900-level, language, physical education, studio or laboratory courses.

Summary of Course Requirements for BME PhD Candidates

Note: The following courses, although offered by the College of Engineering, do **not** meet the requirement of a technical elective: BE 795, ME 502, ME 517, ME 518, ME 525, ME 550, ME 583, ME 584, ME 703 and EK 731. SPH

PH 825 also does not qualify as a technical elective. Students may also petition for a course offered outside of ENG to count as a technical elective using the BME petition form.

Post-BS PhD Students (Post-Bachelor's):

BE 790 *Biomedical Engineering Seminar*
BE 791 *Biomedical Engineering Laboratory Rotations* (Students will register for 1 credit in the fall semester and 2 credits in the spring semester – one credit per rotation)
QBP fellows perform four lab rotations (1 in the fall, 2 in the spring and 1 in the summer)
BE 792 *Literature Review* (spring semester of the first year, 2 credits)
BE 605 *Molecular Bioengineering* (fall semester of the first year, 4 credits)
If you have had prior coursework that you feel overlaps substantially with this material, you can discuss with the instructor the possibility of waiving this course requirement. Waivers must be approved by the BME Graduate Committee using the BME petition form (available online).
BE 606 *Quantitative Physiology for Engineers* (spring semester of the first year, 4 credits)
If you have had prior coursework that you feel overlaps substantially with this material, you can discuss with the instructor the possibility of waiving this course requirement. Waivers must be approved by the BME Graduate Committee using the BME petition form (available online).
Three Graduate-Level BME Electives
Two Graduate-Level Technical Electives (may include additional BME coursework)
Note: Some courses offered in the College of Engineering relate to product development or engineering management and do not qualify as technical electives. If in doubt about a course, students should consult with Christen Bailey.
Math Requirement (selected from approved list included in handbook). It is strongly recommended that this be completed during the first year. Both passing the oral qualifier exam and satisfying the math requirement are required in order to achieve PhD candidacy!
Teaching Practicum (BE 801 and BE 802) All PhD students are required to teach two semesters. Typically the first teaching assignment (BE 801) is during the second year and the second assignment (BE 802) is during the third year. BE 801 and BE 802 each count for 4 credits and students require permission of their research advisor if they want to take an additional course during the semester that they are teaching.
BE 900/991 Research (minimum of 12 credits)

Post-Bachelor's PhD students must complete a minimum of **64 credits** (formal courses plus research credits) prior to graduation, earning at least 56 credits at BU. If approved by the student's advisor and the BME Graduate Committee (using the BME petition form), additional courses that do not necessarily satisfy a program requirement but would be beneficial to the student's research or career goals are allowed.

All Post-Bachelor's PhD degree students may declare a Master of Science degree when they complete the prospectus – **THIS IS NOT AUTOMATIC**. Please submit the MS Program Planning Sheet and apply for graduation online.

Post-MS PhD Students (Post-Master's):

BE 790 *Biomedical Engineering Seminar*
BE 791 *Biomedical Engineering Laboratory Rotations* (Students will register for 1 credit in the fall semester and 2 credits in the spring semester – one credit per rotation)
QBP fellows perform four lab rotations (1 in the fall, 2 in the spring and 1 in the summer)
BE 792 *Literature Review* (spring semester of the first year, 2 credits)
BE 605 *Molecular Bioengineering* (fall semester of the first year, 4 credits)
If you have had prior coursework that you feel overlaps substantially with this material, you can discuss with the

instructor the possibility of waiving this course requirement. Waivers must be approved by the BME Graduate Committee using the BME petition form.
BE 606 *Quantitative Physiology for Engineers* (spring semester of the first year, 4 credits)
If you have had prior coursework that you feel overlaps substantially with this material, you can discuss with the instructor the possibility of waiving this course requirement. Waivers must be approved by the BME Graduate Committee using the BME petition form (available online).
Two Graduate-Level Technical Electives (at least one BME) Students will be advised individually about what courses to take, which may depend on the specifics of their MS degree.
Note: some courses offered in the College of Engineering relate to product development, and do not qualify as technical electives. If in doubt about a course, students should consult with Christen Bailey.
Math Requirement (selected from approved list (located in the handbook and online). It is strongly recommended that this be completed during the first year. Both passing the oral qualifier exam and satisfying the math requirement are required in order to achieve PhD candidacy! (*Potentially may be waived, using the BME petition form, for Post-MS students who have taken graduate-level math courses at another school*)
Teaching Practicum (BE 801 and BE 802) All PhD students are required to teach two semesters. Typically the first teaching assignment (BE 801) is during the second year and the second assignment (BE 802) is during the third year. BE 801 and BE 802 each count for 4 credits and students require permission of their research advisor if they want to take an additional course during the semester that they are teaching.
BE 900/991 Research (minimum of 4 credits)

Note: There is no "typical" Post-Master's PhD. At the discretion of the BME Graduate Committee, fewer courses may be allowed, depending on prior coursework. In total, Post-MS students must complete a minimum of **32 credits** (comprised of formal courses plus research course credits) at BU. If approved by the student's advisor and the BME Graduate Committee (using the BME petition form), additional courses that do not necessarily satisfy a program requirement but would be beneficial to the student's research or career goals are allowed.

MD/PhD Students:

BE 790 *Biomedical Engineering Seminar*
BE 791 *Biomedical Engineering Laboratory Rotations* (Students will register for 1 credit in the fall semester and 2 credits in the spring semester – one credit per rotation)
QBP fellows perform four lab rotations (1 in the fall semester, 2 in the spring semester and 1 in the summer)
BE 792 *Literature Review* (spring semester of the first year, 2 credits)
BE 605 *Molecular Bioengineering* (fall semester of the first year, 4 credits)
If you have had prior coursework that you feel overlaps substantially with this material, you can discuss with the instructor the possibility of waiving this course requirement. Waivers must be approved by the BME Graduate Committee using the BME petition form (available online).
BE 606 *Quantitative Physiology for Engineers* (spring semester of the first year, 4 credits)
If you have had prior coursework that you feel overlaps substantially with this material, you can discuss with the instructor the possibility of waiving this course requirement. Waivers must be approved by the BME Graduate Committee using the BME petition form (available online).
Three Graduate-Level Technical Electives (at least one BME)
Note: some courses offered in the College of Engineering relate to product development, and do not qualify as technical electives. If in doubt about a course, students should consult with Christen Bailey.
Math Requirement (selected from approved list (located in the handbook and online). It is strongly recommended that this be completed during the first year. Both passing the oral qualifier exam and satisfying the math requirement are required in order to achieve PhD candidacy!
Teaching Practicum (BE 801 and BE 802) All PhD students are required to teach two semesters. Typically the first teaching assignment (BE 801) is during the second year and the second assignment (BE 802) is during the third year. BE 801 and BE 802 each count for 4 credits and students require permission of their research advisor

if they want to take an additional course during the semester that they are teaching.
BE 900/991 Research (4 credits)

MD/PhD students have course requirements that are a hybrid between those of Post-BS and Post-MS PhD students. Students must enroll for a total of **48 credits** prior to receiving the PhD degree. If approved by the student's advisor and the BME Graduate Committee (using the BME petition form), additional courses that do not necessarily satisfy a program requirement but would be beneficial to the student's research or career goals are allowed.

All PhD Students (during each semester of teaching assignment):

BE 801 and BE 802 *Teaching Practicum I and II* (4 credits each) All PhD students assigned to teach for the first time are required to register for BE 801 during the semester of their formal teaching assignment. During the second assignment, students must register for BE 802. During the semester in which the student teaches, he/she may only register for 8 credits (BE 801 or BE 802 plus 4 credits of BE 900/991). Students may take a structured course while teaching only if they receive permission from their research advisor (credit limit would then be 10 – 4 for BE 801 or BE 802, 4 for the course and 2 for BE 900/991).

Credit for Courses Taken Elsewhere:

Students may "place out" of required courses (but not electives, BE 900 or BE 991), if they have taken equivalent courses elsewhere at the graduate level, *as long as those courses were not used to meet the requirements of an undergraduate or previous degree*. For example, students who have taken a graduate-level physiology course may receive permission not to take BE 606. Students with extensive experience in quantitative molecular biology may receive permission not to take BE 605. This permission must be granted by submitting a petition to the BME Graduate Committee BEFORE the end of the Add/Drop period to waive the requirement. **Though students may place out of specific course requirements, this does not alter the total number of credits a student must earn at Boston University (56 or more for Post-BS PhD students, 32 for Post-MS PhD students) to meet the degree requirements**.

Courses that Fulfill the BME Math Requirement:

Students must complete one 4-credit or two 2-credit math courses (BE 601-604) from the list below and pass with a B+ or higher. Students may petition for a different course (500-level or higher) to satisfy the math requirement.

ENG EC 505 Stochastic Processes An introduction to discrete and continuous-time random processes. Correlation and power spectral density functions. Linear systems driven by random processes. Optimum detection and estimation. Bayesian, Weiner and Kalman filtering.

ENG EK 501 Mathematical Methods I: Linear Algebra and Complex Analysis An introduction to basic applied mathematics for science and engineering, emphasizing practical methods and unifying geometrical concepts. Topics include linear algebra for real and complex matrices. Quadratic forms, Lagrange multipliers and elementary properties of the rotation group. Vector differential and integral calculus. Complex function theory, singularities and multi-valued functions, contour integration and series expansions. Fourier and Laplace transforms. Elementary methods for solving ordinary linear differential and systems of differential equations with applications to electrical circuits and mechanical structures.

CAS MA 561 Methods of Applied Mathematics I Derivation and analysis of the classical equations of mathematical physics; heat equation, wave equation, and potential equation. Initial boundary value problems,

method of separation of variables, eigenvalue problems, eigenfunction expansions. Fourier analysis. Existence and uniqueness of solution.

CAS MA 565 Mathematical Models in the Life Sciences An introduction to mathematical modeling, using applications in the biological sciences. Mathematics includes linear difference and differential equations, and an introduction to nonlinear phenomena and qualitative methods. An elementary knowledge of differential equations and linear algebra is assumed.

CAS MA 579 Numerical Methods for Biological Sciences An introduction to the use of numerical methods for studying mathematical models of biological systems. Emphasis on the development of these methods; understanding their accuracy, performance, and stability; and their application to the study of biological systems.

CAS MA 684 Applied Multiple Regression and Multivariable Methods Application of multivariate data analytic techniques. Multiple regression and correlation, confounding and interaction, variable selection, categorical predictors and outcomes, logistic regression, factor analysis, MANOVA, discriminant analysis, regression with longitudinal data, repeated measures, ANOVA.

CAS PY 501 Mathematical Physics An introduction to complex variables and residue calculus, asymptotic methods, and conformal mapping; integral transforms; ordinary and partial differential equations; non-linear equations; integral equations.

students are required to take BE 601 plus BE 602, BE 603 or BE 604 to satisfy the requirement

ENG BE 601 Linear Algebra The first of four math modules designed to reinforce basic mathematical and computer programming concepts pertinent to graduate research in biomedical engineering. This course will emphasize the five cornerstones of applied linear algebra: Linear combinations, decompositions, orthogonality, metric, and linear transformations. Topics include LU and QR factorizations, finite difference methods for solving partial differential equations (PDEs), least squares, Fourier series and wavelets, solid mechanics, Markov chains, principal component analysis, and signal processing techniques. This course will provide the necessary linear algebra background needed to solve problems in BE 602, 603 and 604.

ENG BE 602 Ordinary Differential Equations This math module will focus on four key ODE concepts: Linear dynamical systems, nonlinear conservative and excitable systems, discrete- time state machines, and generalized Fourier series solutions to Sturm-Liouville problems. Topics include: Filters, enzymatic networks, mechanical models for biomaterials, oscillators and limit cycles, phase- locked loops, nonlinear Leslie matrices, Legendre polynomials, Bessel functions, and a prelude to solving PDE problems associated with heat transfer, diffusion, and electrostatics. Prior exposure to linear algebra (BE 601 or equivalent), and working knowledge of a programming language (Matlab, Python, etc.) is helpful.

ENG BE 603 Partial Differential Equations This math module will focus on elliptical and parabolic PDEs associated with transport phenomenon problems in biomedical engineering. We will visit four PDE concepts: Separation of variables, integral transform solutions, superposition principles, and numerical approximations using finite-difference schemes. Topics include: 2D and 3D anisotropic Laplace's, Poisson's, and the heat equations in different coordinate systems, Fourier and Laplace transform solutions, 2D ADI methods, Green's functions, and the method of images. Prior exposure to linear algebra (BE 601 or equivalent), ODEs (BE 602 or MA 226 equivalent), Fourier series, Fourier and Laplace transforms (BE 401 equivalent), and working knowledge of a programming language (Matlab, Python, etc.) is highly recommended.

ENG BE 604 Statistics and Numerical Methods This math module will focus on how linear algebra, ODEs, statistics, and signals & systems techniques can be used to interrogate data from biological and engineering experiments. The lecture topics include: Jacobi, Gauss-Seidel, and SOR iterative solvers for large linear systems; Gauss-Newton iterations (nonlinear least-squares); the ANOVA table, multi- factor regression, and intro to the general linear model (GLM); data deconvolution; Monte Carlo, bootstrap, and kernel density estimation. Prior exposure to linear algebra (BE 601 equivalent), basic probability and statistics (BE 200 equivalent), and working knowledge of a programming language (Matlab, Python, etc.) is highly recommended.

ENG BE 747 Advanced Signals and Systems Analysis for Biomedical Engineering Introduction to advanced techniques for signals and systems analysis with applications to problems in biomedical engineering research. Time-domain and frequency-domain analysis of multiple input, multiple output systems using the fundamental matrix approach. Hilbert transform relations; applications to head- related transfer functions. Second-order characterization of stochastic processes: power density spectra, cross-spectra, auto-and cross-correlation functions. Gaussian and Poisson processes. Models of neural firing patterns. Effects of linear systems on spectra and correlation functions. Applications to models of the peripheral auditory system. Optimum processing applications. Applications to psychophysical modeling. Introduction to wavelets and wavelet transforms. Wavelet filter banks and wavelet signal processing.

ENG ME 566 Advanced Engineering Mathematics Introduces students of engineering to various mathematical techniques that are necessary in order to solve practical problems. Topics covered include a review of calculus methods, elements of probability and statistics, linear algebra, transform methods, difference and differential equations, numerical techniques, and mathematical techniques in optimization theory. Examples and case studies focus on applications to several engineering disciplines. The intended audience for this course is advanced seniors and entering MS engineering students who desire strengthening of their fundamental mathematical skills in preparation for advanced studies and research.

GRS MA 681 Accelerated Introduction to Statistical Methods for Quantitative Research Introduction to statistical methods relevant to research in the computational sciences. Core topics include probability theory, estimation theory, hypothesis testing, linear models, GLMs, and experimental design. Emphasis on developing a firm conceptual understanding of the statistical paradigm through data analyses**.**

Finding a Research Home

Research Opportunities in the Department

Most students choose to do their research with a faculty member from the BME Department or affiliated research centers (Biological Design Center, Biomolecular Engineering Research Center, BUnano, Center for Future Technologies in Cancer Care, Center for Memory and Brain, Center for Research in Sensory Communication and Neural Technology, Hearing Research Center). To find out more about specific research programs, please visit the individual faculty member webpages via the BME website. Faculty, scientists or researchers (holding a PhD or MD) within or outside of Boston University can be approved by the BME Graduate Committee using the PhD Supervisor Approval Form to be a student's principal research advisor if they have an active research collaboration with a primary BME faculty member who will agree to be the student's research Co-Advisor and Academic Advisor.

Research Project

A major requirement for the PhD degree is a research-based dissertation. Each student is responsible for finding a research project, conducting scientific studies under the guidance of an approved faculty member, presenting the Prospectus and results to the general scientific community in a public defense and finally turning in a dissertation to be bound for the library and the BME Department.

Academic vs. Research Advisors

Each new student is assigned an academic advisor when entering the program. Incoming PhD students will be notified about their advisor prior to registration by Christen Bailey. The student's academic advisor can provide general information/guidance and help the student to complete his/her course registration for the first year.
PhD students will participate in laboratory rotations (typically three) during the first year. This provides the students an opportunity to gain exposure to more than one research area and to help in identifying a good match with a research advisor. After finding a lab, the research advisor will be in charge of the student's research project and will help coordinate the student's schedule towards fulfilling all of the graduation requirements. **PhD students, unless a QBP fellow, are expected to choose a research advisor no later than the end of the second semester of matriculation (April 30, 2018 deadline).**

When a student chooses his/her research advisor, that person automatically becomes the student's Academic Advisor as well. However, if the student's principal research advisor is not a BME full-time primary or affiliated faculty member (but has an active research collaboration with a primary BME faculty member), then a BME co-advisor is required. A primary BME faculty member with an active research collaboration with the off-campus research advisor will become the student's Academic Advisor and research Co-Advisor. This Academic Advisor is expected to be a member of the student's committee and a "Co-First Reader".

Who Can Be a Research Advisor

For PhD students, any full-time member of the BME faculty, or any affiliated or adjunct faculty member who has an appointment with the department, is eligible to serve as a research advisor unless otherwise noted. Other faculty, scientists or researchers (those holding a PhD or MD) within or outside of Boston University can be approved by the BME Graduate Committee to be a student's principal research advisor if they have an active research collaboration with a primary BME faculty member who will agree to be the student's research Co-Advisor. Students should submit a PhD Supervisor Approval form, to be approved by the BME Graduate Committee. This form should be submitted as soon as the potential advisor is selected (April 30, 2018 deadline). After approval, and as their research project progresses, PhD students must identify two additional primary BME faculty members for their committees.

Finding a Research Advisor and Project

Occasionally students enter the program with a specific research advisor in mind and may even plan to work on a specific project. The majority of students, however, will utilize the first two semesters to determine what their specific interests are in the field of biomedical engineering and identify the opportunities for funding in potential lab. PhD students typically connect with their research advisors through the mechanism of their lab rotations. In general, the procedure involves three steps: (1) doing rotations and deciding upon a research area; (2) joining a specific lab; and (3) developing a dissertation research project. All three rotations should be completed by the end of the academic year (see above exemption for QBP fellows). **DRF positions should begin May 1, 2018.**

Students can gain information about steps (1) and (2) through coursework, mandatory attendance of the BE 790 seminar during Fall 2017, informal discussions with faculty and, most importantly, the lab rotations. An easy way to find out what is available is to check the list of current Faculty Research Interests and BME Laboratory and Research Center Descriptions, available on the BME website.

Another valuable way of learning more about specific research opportunities is to speak with other graduate students who are currently working in department's various labs. The best measure for learning about working in a specific lab is to make an appointment to speak with the faculty member in charge of a lab you are interested in. Some useful questions to ask him/her are:

1. What projects are currently going on and what projects are planned for the near future?

2. What background is required to work in the lab?
3. How is the lab funded and is there the possibility of funds for a new graduate student?
4. What expectations does the faculty member have of graduate students?
5. If the potential advisor has been at BU for at least a few years, does he/she have a strong history of training students in a timely manner? Have his/her students generally been successful?

Once a student finds a research opportunity and has the consent of a faculty member to be his/her advisor, the process of developing a research project begins.

Off-Campus Research

Dissertation research is usually carried out in laboratories and centers of BME faculty located on campus. In cases of non-BU advisors (see discussion above regarding required approval) the research is often performed off-campus, in the lab of the principal research advisor. There may be special problems that arise due to intellectual property and other conflicts of interest, which must be addressed prior to starting the work. Also, in the case of a non-BU advisor, typically, the funding to pay the student's stipend is transferred through the mechanism of a sub-contract from the advisor's institution to BU.

Invention and Copyright Agreements

Students who receive support from sponsored research programs or who make significant use of University funds and facilities are required to sign the BU Invention and Copyright Agreement. Seek counsel with your faculty advisor about this policy pertaining to intellectual property. A signed Patent Policy for the Charles River Campus form is required before a student can be paid.

Doctor of Philosophy Degree Requirements

All engineering PhD students must adhere to and meet the PhD degree requirements as set forth by the College of Engineering. Additionally, BME PhD students must also meet any specific degree requirements as set forth by the BME Department.

The general requirements for all PhD students in BME include:

- fulfillment of course requirements
- passing the oral qualifier exam
- Prospectus Defense
- Dissertation Defense

PhD students need to submit a *Program Planning Sheet* for approval by their Academic Advisor and the Associate Chair for Graduate Studies. This is to be completed when the student defends their Prospectus. A cumulative grade point average of 3.0 must be maintained and no course with a grade lower than B- can be counted towards the degree.

Oral Qualifier Exam and PhD Candidacy

The BME PhD Oral Qualifier Examination

The Oral Qualifier Exam is taken during the early summer (usually June) following the first academic year in the graduate program. The exam is based on the student's ability to read, understand, critically evaluate and discuss scientific papers in an oral examination format. The goals are as follows:

- Assess the student's command of general core knowledge required for all biomedical engineers.
- Assess the ability of the student to integrate knowledge across disciplines, time scales, and length scales. In particular, students should be able to integrate principles of molecular bioengineering and

quantitative physiology with various topics of research.
- Assess the quantitative and mathematical skills of the student.
- Assess the ability of the student to verbally communicate ideas and information in a clear, logical, and organized fashion.
- Assess the ability of the student to handle questions across a range of topics both within and outside the student's area of interest.
- Assess the ability of the student to critically read and understand scientific publications and to place the results of these publications in the context of the broader Biomedical Engineering field.

Expectations of Students
Each student will be questioned by three examiners. In general, examiners will be selected so that there will be one examiner with specific expertise in each of the two topics selected by the student, while the third examiner will be more at arms-length from the topic. Scheduling constraints may result in variations on this general goal. We expect that students will:

- Read, understand, and critically evaluate every assigned paper.
- Be prepared to answer any questions about the methods, results, and conclusions of the main paper(s).
- Understand any key scientific concepts necessary to explain and understand the main paper(s). This includes, but is not limited to, concepts covered in the core curriculum, e.g. BE 605 and BE 606.
- Be prepared to derive and/or solve quantitative problems associated with each main paper(s).
- Identify, read, and understand key papers necessary to understand the background and context of the main paper. These background papers are typically included in the citations of the main paper(s).
- Be prepared to discuss alternative approaches and potential follow-up studies.
- Justify all answers with reasoned arguments based on established results and data.

Policy Regarding "Partial Pass" and "Fail" Grades for the PhD Oral Qualifier Exam
The grade forms are evaluated by the BME Graduate Committee. In the event that a student fails all or part of the exam, potential outcomes include remedial coursework or an opportunity for a second oral exam on all or part of the material. In some cases, the student will be given the chance to choose between those two options.

Failure of a second attempt at the qualifier exam: There is no automatic recourse for this outcome. The student may apply to transfer to the MS program or MEng program.

PhD Candidacy
Upon successful completion of the Oral Qualifier Exam and satisfying the math requirement, a student becomes formally accepted to PhD candidacy. A PhD candidate has a maximum of five (5) years to complete all degree requirements for graduate studies. If not completed within five years, the student must petition the College of Engineering Graduate Committee for an extension using the College of Engineering petition form. The petition should include the following material:

- Major reason(s) for delay
- How those delays have been resolved
- Evidence of research progress
- Detailed timeline and evidence that timeline can be adhered to
- Letter of support from advisor that addresses these issues

The College of Engineering Graduate Committee will determine whether or not a candidate may extend his/her participation in the PhD program. More than one petition to extend the completion date of degree requirements is rarely approved, so the student should be very sure that they will finish their dissertation by the date they

propose on the extension.

Lab Rotations

BE 791 Biomedical Engineering Lab Rotations
All PhD students (not already funded by a doctoral Research Fellowship) are required to participate in laboratory rotations and enroll in BE 791 *PhD Biomedical Engineering Laboratory Rotation* during their first academic year. During these rotations (typically three), students will become familiar with research activity within departmental laboratories. These rotations will then help students identify the laboratory in which they will perform their research. If you are a participant in the NIH Training Program in Quantitative Biology and Physiology (QBP), you will enroll in four laboratory rotations. The following is an outline of the administrative issues and policies regarding BE 791:

- All PhD students must register for BE 791 in their first and second semesters of matriculation in BME. Students will register for one credit in the fall and two credits in the spring semester, for a total of three. (1 credit = 1 rotation) The course is graded Pass/Fail.
- Rotations generally last 6-8 weeks. If students are unable to complete two rotations in their second semester, they must request permission from the BME Graduate Committee and Matt Barber to rotate over the summer.
- To do a rotation with a faculty member who does not have a primary or secondary appointment in BME, students must petition and receive permission from the BME Graduate Committee using the BME petition form (available online). QBP fellows must receive permission to do rotations with faculty outside the list of approved labs (see "*Training Program in Quantitative Biology and Physiology*" section of the handbook). For students with fellowships in other NIH training programs, other requirements may pertain to rotations, which will be communicated individually.
- Students who matriculate into the BME PhD program funded by an external fellowship are not exempt from participation in the lab rotation program. However, students who matriculate as a DRF may be allowed to petition out of BE 791. If a student finds a permanent lab position after their second rotation, they can petition for a waiver of the third rotation. QBP fellows must complete three rotations but can petition for a waiver of the fourth rotation via BME petition.

Grades for BE 791 (Pass/Fail) will be submitted after receipt of 1) a brief summary of the rotation provided by the student and 2) a brief review of the student's participation by the advisor. These two items must be submitted via email to Christen Bailey.

Prospectus and Dissertation

Dissertation Topic
A research problem is selected after initial discussions between the research advisor and the student. The development of a dissertation topic is typically a cooperative effort between the student and Research Advisor. Commonly, the advisor initially suggests a problem to be addressed, but the student is expected to contribute ideas and thought as to how to approach the problem.

Prospectus Committee
By the end of the sixth semester following matriculation, PhD candidates are required to form a Prospectus Committee and defend a dissertation prospectus. Prospectus is defined as a public oral presentation of the proposal is held to describe the research and demonstrate the student's preparation.

A Prospectus Defense will be scheduled by the student. The PhD Prospectus Defense Committee must consist of at least four (4) members:

- **Two members must be from the primary BME faculty**
- **One member must be from the College of Engineering but outside of the BME department** (BME Affiliated faculty, Research faculty and Research Associates with a PhD and sufficient experience may count as the "outside" member)
- **One member must be from a different department or institution**

BME Research faculty may count towards the BME faculty requirement or may also fill the role of a non-BME committee member. The student's Research Advisor (or Academic Advisor/Co-Advisor if Research Advisor isn't BU faculty) will be the Chair but will not be a voting member of the committee. Membership of the Prospectus Committee constitutes the nucleus of the Final Oral Thesis Examination Committee (Dissertation Defense).

If a researcher from outside the University serves on a PhD student's committee, a *Special Service Appointment Form* must be completed and submitted to Christen Bailey for departmental approval. The completed form and a copy of the person's curriculum vitae, with the Associate Chair for Graduate Studies signature, will then be submitted to the Graduate Programs Office. The Prospectus Committee is charged with assessing the appropriateness of the research problem and the student's preparation, based on the written proposal and the oral presentation. The Prospectus Committee must approve that the prospectus is at a stage appropriate for scheduling the examination via their signature on the PhD Prospectus Defense form.

Written Prospectus

Before undertaking this phase, the student should consult the College's Guide for Writing Theses & Dissertations. The prospectus document should include a signature page, a statement of the problem to be investigated, its background and significance, methods and approach(es) to be followed for its resolution, preliminary results, anticipated timetable for completion and pertinent bibliography. The format is similar to a typical research proposal.

- The prospectus should specifically document the anticipated contribution of the work to the body of knowledge
- A separate page listing the proposed title, author's name, research advisor's name and an abstract of approximately 150 words
- The prospectus should address the anticipated contribution of the work to the body of knowledge and the format must be similar to that of proposals submitted to a Federal Agency (ex. NRSA F31)
- There is a 20 page (single-spaced) limit on the scientific portion of the proposal, which includes tables and figures but does not include the list of references
- The prospectus should include an up-to-date copy of the student's curriculum vitae (not part of the 20-page limit)

The PhD Prospectus Defense form is to be handed in to Christen Bailey two weeks prior to the defense along with the abstract. The student must obtain the committee's ORIGINAL signatures on this form, which indicate that they have read the Prospectus document and approve that the examination be scheduled. In addition, the student must fill out the top section of this form indicating the title, date, time and location of the Prospectus Defense. The student submits this completed form immediately following the Prospectus Defense examination for approval by the Associate Chair for Graduate Studies.

Scheduling

Prior to scheduling the Prospectus Defense, the student must provide a copy of the prospectus document to all members of the Prospectus Defense Committee. The student must also confirm with the committee members

a date, time and location for the examination. Christen Bailey will be responsible for providing publicity for the student's Prospectus Defense to BME students and faculty and adding the event to the BME calendar.

Conduct and Length of the Oral Examination for the Prospectus Defense
The faculty research advisor should chair the Prospectus Defense, beginning with the introduction of the PhD student and his/her academic background. The student's presentation should last 20 to 30 minutes. The student should be able to defend his/her knowledge of the mathematical, physical and analytical tools to be used and how they may relate to other areas outside of his/her particular project. During this period, Prospectus Committee members or the audience may ask questions. The Chair should guard against digressions and inappropriate questioning during the presentation. Following a reasonable question period, the student and the audience are dismissed and the Prospectus Committee remains to complete its assessment.

Assessment
The Prospectus Committee recommends that the student should **Pass, Fail, or Conditionally Pass**. A conditional pass includes additional requirements (e.g., an additional written progress report or additional studies) to be completed no later than one year from the Prospectus Defense examination. In the case of failure, the Prospectus Committee recommends the appropriate action: a recommendation of failure may include a suggestion that the student re-take the Prospectus Defense exam or that the student be terminated from the PhD program. In the latter case, the student has the option of pursuing an MS or MEng degree but must complete all the requirements for that degree.

As of Fall 2005, all Post-Bachelor's PhD degree students should declare a Master of Science degree when they successfully complete their PhD Prospectus Defense. **This is not automatic** and the student needs to complete an *MS Program Planning Sheet* and apply online for graduation.

If a student's Prospectus Defense deadline has passed, he/she needs to petition the BME Graduate Committee for an extension, including indicating a timeline for completion of the prospectus.

Reporting on Student Progress
The Chair of the Prospectus Committee will complete the Results section on the *PhD Prospectus Defense* form. If the student is required to meet certain conditions, those conditions should be listed on a separate sheet and attached to the form. Those conditions should also contain time frames for completion. The Chair then signs the form and forwards it to Christen Bailey (who will be responsible for submitting to the Associate Chair for Graduate Studies for final approval). Before the Prospectus Defense ends, the committee must indicate on the PhD Prospectus Defense form the date for the next committee meeting (at least once in the next 12 months) and indicate expected milestones for the next post-prospectus committee meeting. Required revisions to the proposal should be completed satisfactorily before a final "Pass" grade is given. Dissertation Committee meetings are to be held on a regular basis in order for the student to report progress and the committee to provide feedback. **As a minimum, committee meetings will be held annually.** The student must forward to his/her committee a written report (*Post-Prospectus Thesis Committee Meeting Report*) detailing progress towards milestones and the next planned steps at least one week before each planned meeting. It is the responsibility of the student to contact the committee members and schedule the committee meetings.

Responsible Conduct of Research Requirement
PhD candidates are required to complete the Responsible Conduct of Research (RCR) requirement before they can receive the post-prospectus stipend rate increase.

Course Registration After Prospectus Requirement Satisfied
After passing the Prospectus Defense, candidates will enroll for eight credits of BE 900/991 each semester until the total minimum credit requirement is met (64 credits for Post-BS, 32 credits for Post-MS and 48 credits for

MD/PhD). Once the student has fulfilled the total minimum credits requirement, he/she will register for two BE 900/991 credits each semester until they graduate, including in the summer.

Written Dissertation
Candidates shall demonstrate their abilities for independent research and scholarship by completing a doctoral dissertation in their field of study. The dissertation will be primarily guided by the First Reader (Advisor), with the advice of the other members of the Dissertation Defense Committee. The dissertation should represent original scientific/engineering contributions that are appropriate for publication in a recognized peer-reviewed journal. The dissertation is defended at a presentation open to the entire BU community.

Guidelines for preparing the dissertation and its abstract, according to the requirements of the University Microfilms International, are distributed by Mugar Library to all doctoral candidates and are available on the BME website. Although students will have an opportunity to make final revisions to the dissertation and abstract after their Final Oral Examination (Dissertation Defense), they should not regard their Final Oral Examination version as a "rough draft".

Final Oral Examination (Dissertation Defense)
The Dissertation Defense is a public presentation of the candidate's dissertation. The presentation should clearly define the problem, describe the method(s) used to solve the problem, report results and establish significance of the results. The purpose is to ensure that the dissertation constitutes a worthy contribution to knowledge in the candidate's field and that the candidate has attained an expertise in his/her field of research specialization.

Final Oral Examination (Dissertation Defense) Committee
In preparation for the Dissertation Defense, it is the candidate's responsibility, in conjunction with that of his/her research advisor, to appoint a Dissertation Defense Committee. This committee usually consists of the faculty members who participated in the Prospectus Defense, and have followed the student's progress and annual progress meetings.

The committee consists of five (5) readers:

- **Two members must be from the primary BME faculty**
- **One member must be from the College of Engineering but outside of the BME department** (BME Affiliated faculty, Research faculty and Research Associates with a PhD and sufficient experience may count as the "outside" member)
- **One member must be from a different department or institution**
- **A fifth member must be from one of the above categories**

If a researcher from outside the University serves on Dissertation Defense Committee, a *Special Service Appointment Form* must be completed. The completed form and a copy of the person's curriculum vitae, with the Associate Chairman for Graduate Studies signature will be submitted to the Graduate Programs Office after receiving departmental approval. This form does not have to be re-submitted if it was approved for the Prospectus Defense.

Christen Bailey will appoint the chair for the Dissertation Defense. It must be a primary BME faculty member on the committee who is not the student's Research Advisor or BME Academic Advisor/Co-Advisor.

Scheduling the Final Oral Examination (Dissertation Defense)
It is the student's responsibility for scheduling a date, location and time with all the Dissertation Defense Committee members for the examination. Conference room reservations can be requested via the BME website.

At least two weeks prior to the Dissertation Defense date, the candidate must submit the *PhD Final Oral Examination* form to Christen Bailey. Before submitting this form, the candidate must have provided a copy of the dissertation document to all members of the Final Oral Examination committee and obtained their ORIGINAL signatures on this form indicating 1) that they have been provided a copy of the dissertation and 2) agree that it is ready to be defended. This form must also contain the date, time, location, title and abstract.

Conduct and Length of the Final Oral Exam

The faculty Research Advisor or Chair should introduce the candidate and include a brief academic background description. The candidate should restrict the length of the examination to approximately one-hour. During this period, either the Dissertation Defense Committee members or audience may ask questions of clarification. The chair should guard against digression and inappropriate questioning during the presentation. After the presentation, a reasonable period of questioning will follow, and then the audience will be dismissed. The Dissertation Defense Committee may wish at this time to ask additional questions of the candidate. Following this, the candidate should be excused and the committee should complete its assessment.

Assessment

The Dissertation Defense Committee is charged with assessing completeness of the research, contribution to knowledge, and the candidate's mastery of his/her research area, based on the written dissertation and the oral presentation. Vote may be ballot or voice. A unanimous vote is required for a candidate to pass.

It is the Chair's responsibility to call the candidate back after the Dissertation Defense Committee has reached a decision. The Chair will advise the student of the committee's decision. At this time the candidate will be advised of any changes that must be made to the final title, abstract or dissertation document, with a deadline provided by the Dissertation Defense Committee.

Reporting

The College's *PhD Final Oral Examination Form* must be completed at the examination, with specific indication of whether the title, abstract and dissertation are acceptable as they stand. If ALL requirements are acceptable, the committee members should sign the signature pages of the dissertation. If there is some rework to be done, this is to be noted on the Final Oral Exam form. Dissertation Defense Committee members should sign off on the form but will refrain from signing the signatures page of the dissertation until all conditions have been met.

Dissertation Approval and Library Submission

The signatures of the Dissertation Defense Committee members on the dissertation signatures page, if not given at the Final Oral Examination itself, will indicate final approval of the title, abstract and dissertation. Once signatures have been obtained, the student must submit the following (minimum) unbound dissertation copies to Christen Bailey for binding: one copy for the BME Department and one personal copy for the candidate. Copies for the Dissertation Committee are optional and to be submitted for binding at the candidate's discretion. All copies must have original signatures pages.

The Associate Chair for Graduate Studies gives final approval on the Final Oral Examination form. The student will then follow the electronic submission guidelines provided by Mugar Library. Christen Bailey will provide departmental electronic approval for the student upon seeing the 1) original signatures page and 2) title page.

Christen Bailey will handle the binding of the additional dissertation copies. The cost for hardbound copies is $10.00 per copy (subsidized by the BME Department). Dissertations to be hardbound are sent to an external bindery once a year (early fall). Students should be sure to leave a correct forwarding address after graduation so that their hardbound copy of the dissertation can be mailed.

PhD Program Completion Time Schedule

- Course requirements should be completed as early as possible. After all credit requirements have been fulfilled, PhD students are permitted to audit one course per semester in order to continue to take advantage of course offerings.
- It is highly recommended that the Math Requirement be completed during the first two semesters.
- The BME Oral Qualifier Exam is taken in early summer (usually June) following the first academic year. Schedules will be set by the BME Graduate Committee.
- The Prospectus Defense should be presented by the end of the sixth semester from matriculation.
- PhD students have five years to complete the dissertation after becoming a PhD candidate. Meetings with the thesis committee must occur at least annually following the Prospectus Defense, and must be documented by submission of the *Post-Prospectus Thesis Meeting Report* form to Christen Bailey.

Financial Information

Students receiving any form of financial support for graduate studies are not permitted additional employment without prior written approval from both the student's advisor and the department.

Stipend Paychecks
All students are expected to have a bank account in the U.S. Direct Deposit of payments to your bank account is the norm for most students. If you elect not to use direct deposit, paychecks can be picked up at the BU Payroll Office at 25 Buick Street on the last Friday of the month.

Doctoral Research Fellows (DRF's)
This is a compensated service appointment exclusively for PhD students engaged to assist on a research project. Students interested in an off-campus advisor should speak with the Associate Chair for Graduate Studies for departmental approval (to ensure that the research project is appropriate and that there is direct involvement of a BME faculty member).

The following is an outline of the Biomedical Engineering Department's policy on stipend levels:

- All incoming PhD students on a fellowship will receive the same monthly stipend at the base rate
- Upon fully passing the Oral Qualifier Exam, PhD candidates will receive a stipend increase of 5% above the current base rate
- PhD candidates will receive an additional 5% increase once 1) they fully pass the Prospectus Defense **and** 2) complete the Responsible Conduct of Research (RCR) training

A Doctoral Research Fellow is a member of a research group in a laboratory or center. The position offers close association with members of the faculty and is a very effective arrangement for graduate study. Work on the dissertation project is normally part of an assistant's assignments. DRF's are expected to work full-time, with time allowed for courses during the academic year.

Tuition
DRF's supported full-time by a faculty's sponsored research grant typically receive full tuition coverage. Eligible RDF's receive 8 credits of tuition, applicable to their degree, each semester they serve as a DRF during the academic year.

Summer Stipends and Tax Withholding
Students funded on fellowships other than NIH will have FICA taxes withheld from their paychecks during the summer (May, June, July and August).

National Institutes of Health Training Program in Quantitative Biology and Physiology (QBP)

There are two core required courses in quantitative biology and physiology for all QBP fellows and each has a laboratory component (**BE 605: Molecular Bioengineering and BE 606: Quantitative Physiology**). The additional required courses are in areas of quantitative and engineering-based systems biology and physiology and in measurement techniques. Table A provides an overview of these courses.

TABLE A: QUANTITATIVE AND ENGINEERING BASED BIOLOGY AND PHYSIOLOGY COURSES

Molecular and Genetic Engineering	Cellular-to-Tissue Level Engineering	Tissue-to-Organ Level Engineering	Scale-Independent Analysis/Modeling	Measurement Techniques
BE 560: Biomolecular Architecture	BE 504: Polymers & Soft Materials	BE 508: Quantitative Studies of Respiratory & Cardiovascular Systems	BE 504: Polymers & Soft Materials	BE 511: Biomedical Instrumentation
BE 562: Computational Biology	BE 521: Continuum Mechanics for Biomedical Engineers	BE 509: Quantitative Physiology of the Auditory System	BE 519: Speech Signal Processing	BE 515: Introduction to Medical Imaging
BE 567: Nonlinear Systems in Biomedical Engineering	BE 530: Structure and Function of the Extracellular Matrix	BE 524: Skeletal Tissue Mechanics	BE 521: Continuum Mechanics for Biomedical Engineers	BE 517: Optical Microscopy of Biological Materials
BE 564: Biophysics of Large Molecules	BE 533: Biorheology	BE 567: Nonlinear Systems in Biomedical Engineering	BE 533: Biorheology	BE 555: Introduction to Biomedical Optics
BE 566: DNA Structure and Function	BE 535: Cell Mechanics	BE 570: Introduction to Computational Vision	BE 567: Nonlinear Systems in Biomedical Engineering	BE 569: Next Generation Sequencing
BE 568: Systems Biology of Human Disease	BE 549: Structure and Function of the Extracellular Matrix	BE 710: Neural Plasticity & Perceptual Learning	BE 703: Numerical Methods & Modeling in BME	BE 570: Introduction to Computational Vision
BE 569: Next Generation Sequencing	BE 567: Nonlinear Systems in Biomedical Engineering	BE 726: Fundamentals of Biomaterials	BE 747: Advanced Signals & Systems for BME	BE 716: Quantitative Medical Imaging
BE 745: Nanomedicine	BE 707: Quantitative Studies of Excitable Cells	BE 727: Principles and Applications of Tissue Engineering	MA 565: Math Models in the Life Sciences	BE 726: Fundamentals of Biomaterials
BE 767: Protein & Genomic Systems Engineering	BE 726: Fundamentals of Biomaterials	BE 771: Introduction to Neuroengineering		BE 727: Principles and Applications of Tissue Engineering
BE 768: Biological Data Base Design	BE 727: Principles and Applications of Tissue Engineering	BE 780: Brain Machine Interfaces		BE 773: Advanced Optical Microscopy
BE 775: Mechanisms & Models of Cellular Regulation	BE 771: Introduction to Neuroengineering	BE 788: Soft Tissue Biomechanics		BI 575: Techniques in Cellular/Molecular Neurophysiology
BE 777: Computational Genomics	BE 775: Mechanisms & Models of Cellular Regulation			
BI 575: Techniques in Cellular/Molecular Neurophysiology	BE 780: Brain Machine Interfaces			
BI 645: Cellular/Molecular Neurophysiology	BI 645: Cellular/Molecular Neurophysiology			

QBP fellows must select at least one course from 3 of the first 4 columns. This ensures that every fellow takes at least two courses synthesizing a quantitative and systems approach at two distinct scales of biology (e.g., molecular-cell, cell-tissue, or tissue-organ) and a third course either at the third biological scale or a course (from column 4) that cuts across multiple scales. Finally, all fellows must then select a course from column 5 covering measurement techniques. This requirement ensures that every fellow is exposed to experimental methods at some level. Satisfying these selections results in six courses. Fellows then must take two additional electives.

Satisfying the Requirements for the PhD in BME

As QBP fellows select their courses they must be cognizant of the general course requirements for all BME students. These requirements consist of the same two required core courses from above (BE 605 and BE 606) and six more electives. Selecting from Table A as described can easily be done in a fashion to satisfy PhD requirements in BME also.

Rotation and Mentor Selection

Students must perform a minimum of three and are encouraged to perform four lab rotations. The rotations must in the laboratories listed in Table B (below) which span four levels of biology and physiology inclusive of a level termed "behavioral or integrative". Students must select from at least three distinct laboratories and ensure these selections cover at least three distinct columns. Moreover, note that several laboratories are listed in multiple columns. This occurs because these faculty members are engaged in research projects that span several biological levels. Students must show that a rotation in a lab for a particular column engaged the student in experiences associated with that column's theme. This rotation system ensures that QBP fellows experience biology over multiple scales, regardless of which laboratory they select for their dissertation topic.

Table B: QBP Laboratory Rotation Areas

Molecular/Genetic Labs	Cellular/Tissue Labs	Tissue/Organ Labs	Integrative/Sensory Labs
Dennis, Allison	Bigio, Irving	Bigio, Irving	Bigio, Irving
Densmore, Doug	Boas, David	Boas, David	Boas, David
Dunlop, Mary	Chen, Chris	Chen, Chris	Chen, Jerry
Galagan, James	Chen, Jerry	Chen, Jerry	Colburn, Steve
Grinstaff, Mark	Colburn, Steve	Colburn, Steve	Damiano, Ed
Khalil, Ahmad "Mo"	Damiano, Ed	Damiano, Ed	Eichenbaum, Howard
Ngo, John	Dunlop, Mary	Grinstaff, Mark	Han, Xue
Segre, Daniel	Eichenbaum, Howard	Han, Xue	Kopell, Nancy
Smith, Michael	Galagan, James	Klapperich, Catherine	Lutchen, Ken
Unlu, Selim	Grinstaff, Mark	Lutchen, Ken	Ngo, John
Wong, Wilson	Hasselmo, Michael	Mertz, Jerome	Ritt, Jason
Zaman, Muhammad	Khalil, Ahmad "Mo"	Morgan, Elise	Roblyer, Darren

	Klapperich, Catherine	Ritt, Jason	Sen, Kamal
	Mertz, Jerome	Sen, Kamal	Shinn-Cunningham, Barb
	Morgan, Elise	Shinn-Cunningham, Barb	Stamenovic, Dimitrije
	Porter, Tyrone	Smith, Michael	Stepp, Cara
	Roblyer, Darren	Stamenovic, Dimitrije	Suki, Bela
	Sgro, Allyson	Stepp, Cara	White, John
	Smith, Michael	Suki, Bela	
	Stamenovic, Dimitrije	Tien, Joe	
	Suki, Bela	White, John	
	Tien, Joe	Wong, Joyce	
	White, John	Zaman, Muhammad	
	Wong, Joyce		
	Wong, Wilson		
	Zaman, Muhammad		

Please note that this table changes every year as new faculty members arrive. Please consult with Prof. John White for any questions regarding laboratory selections.

Program Cohesion, Retention, Enhancement and Information Flow
The program cohesion and cultural components include: monthly journal club and dinners, active involvement in annual retreats and participation on our Annual Symposium in Quantitative Biology and Physiology run by and for QBP and TRB fellows. Each trainee beyond their third year in the BME program gives a talk at the symposium.

Logistical Information

Graduate Student Offices
New PhD students will be assigned a desk in dedicated BME graduate student offices. Faculty lab supervisors should provide desk space in their labs for Doctoral Research Fellows. Christen Bailey will notifying incoming PhD students regarding their individual office assignments and provide a key.

BME Graduate Student Lounge
The BME Lounge is located on the second floor of 44 Cummington Mall near the elevator. This room contains graduate student mailboxes. The mailing address is: *Department of Biomedical Engineering, Boston University, 44 Cummington Mall, Boston, MA 02215.*

BME Kitchenette
There is a small kitchenette (including a refrigerator) that is available for faculty, graduate students and staff in ERB 407. A copy machine is available for students.

Getting to the BU Medical School Campus

BME students often take courses or attend lectures at the BU School of Medicine campus, which is located at 80 E. Concord Street in Boston. A number of students also conduct research at the medical center. Traveling between Boston University's Charles River campus and the Medical Campus is now easy thanks to the enhanced **Boston University Shuttle (The BUS)** service. The Shuttle runs every 10-30 minutes (depending on the day and time) and makes it a snap for the BU community to access the many resources, programs, and activities throughout the University. **IT IS FREE!** Call 877-355-1555 to receive recorded information about The BUS service, including current reports of transportation delays and service interruptions. The closest stop to the BME department is at the corner of Blandford St and Commonwealth Ave. Schedules and real-time bus locations can be found online.

Staff Directory

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