

**Bioengineering Graduate Program
University of Maryland, College Park**

**The Fischell Department of Bioengineering
Student Handbook**

Bioengineering Graduate Program Overview

The Bioengineering Graduate Program offers research and educational opportunities leading to the Doctor of Philosophy degree and to the MS/MD Masters of Science as a Dual Degree program with the University of Maryland School of Medicine. It is housed in and administered by the Fischell Department of Bioengineering. The Bioengineering Graduate Program faculty includes all faculty holding a tenured or tenure-track appointment in the Fischell Department of Bioengineering, as well as faculty holding Affiliate and Adjunct appointments with the Department.

Graduate students in the Bioengineering Graduate Program are students in the Graduate School at the University of Maryland. As such, all students in the Bioengineering Program are subject to the Graduate School's requirements for the conferral of graduate degrees, in addition to the Bioengineering Program's degree requirements. *This document describes the essential steps to the PhD and MS/MD degrees. The handbook is not meant to provide a comprehensive overview of the Graduate School's requirements. Students are urged to refer to the Graduate School's publications and webpage for additional information.* The Graduate School's webpage (including links to their policies, forms, and handbooks) is located at: <http://www.gradschool.umd.edu/>.

Doctor of Philosophy (Ph.D.) Degree Requirements

The Ph.D. program consists of

1. 45 credits of required, restricted and unrestricted elective courses
2. a research aptitude examination (RAE)
3. an oral defense of a written dissertation research proposal
4. preparation and oral defense of a publication-quality dissertation that advances the field.

Required Courses

All students must take the following three Bioengineering courses (9 credits)

BIOE 601 Rate Processes in Biological Systems

BIOE 604 Transport Phenomena in Bioengineering Systems

BIOE 612 Physiological Evaluation of Bioengineering Designs

The laboratory rotation courses BIOE 605/606 (2 credits) and the Bioengineering Seminar Series BIOE 608 (1 credit) are also required. *Attendance at all Bioengineering seminars is expected throughout the graduate student's career, irrespective of whether the course is taken for credit or not.*

Additionally, a total of 18 credit hours of Dissertation Research credits must be taken (BIOE 899). Qualification for advancement to candidacy requires that students earn a GPA of 3.0 or better in each of the core courses. If a student receives a C in a core course, then it must be repeated.

Students must have completed 20 credits and have at least a 3.0 GPA at the end of the second semester to remain in good standing in the PhD program.

The Bioengineering Graduate Program has no explicit requirements regarding prerequisites; however, students are expected to have the Engineering Math and Biology background necessary to be successful at taking the core graduate courses. The Graduate Director may recommend that an incoming student take selected courses with significant Math and/or Biology content prior to attempting the Transport and Bioengineering Design courses.

Elective Courses

In addition to the required courses, each student must take two restricted elective courses (6 credits). Restricted elective course consist of topics spanning fundamental bioengineering disciplines. The list of

restricted electives will be updated every semester with current course offerings. The current restricted electives courses are shown below:

BIOE602	Cellular and Tissue Biomechanics
BIOE 603	Quantitative Cell Physiology
BIOE 611	Tissue Engineering
BIOE 620	Modern Methods of Drug Delivery
BIOE 631	Environmental Biosystems
BIOE 632	Biosensor Instrumentation and Techniques
BIOE 653	Biomaterials
BIOE 689C	Biomedical Optics
BIOE 689M	Cell Engineering

Three more unrestricted electives courses (9 credits) will be selected in consultation with the student's advisor. A list of approved electives can be obtained from the Bioengineering Graduate Program website.

Summary of PhD Course Requirements:

<i>Courses</i>	<i>Credits</i>
3 Required	9
2 Rotation	2
1 Seminar	1
2 Restricted Electives	6
3 Unrestricted Electives	9
Dissertation Research	18
TOTAL	45

Typical Timeline for completion of course requirements:

Fall Semester 1st Year: (10 credits)

- BIOE 601 (3 credits)
- Restricted Elective (3 credits)
- Restricted Elective (3 credits)
- Lab Rotation (1 credit)

Spring Semester 1st Year: (10 credits)

- BIOE 612 (3 credits)
- BIOE 604 (3 credits)
- Unrestricted Elective (3 credits)
- Lab Rotation (1 credit)

Fall Semester 2nd Year: (4 credits)

- BIOE 608 (1 credit)
- Unrestricted Elective (3 credits)

Spring Semester 2nd Year Courses: (3 credits)

- 1 Unrestricted Elective (3 credits)

Points of information on courses and scheduling:

- Pre-candidacy students are required to register for 2 credits/semester of BIOE 898 if they are not taking classes.
- Post-candidacy students will be registered automatically by the graduate school for 6 credits/semester of BIOE 899.

Transfer of Credit:

A candidate may request that up to 6 credit hours of appropriate graduate course work taken at other accredited institutions be applied towards the Ph.D. degree. In general, courses from international universities are not accepted. Prior approval is required if the transfer work is to be taken after admission to the Program. The Graduate Director must agree that the specific courses are appropriate to and acceptable in the student program, and a grade of B or better must have been earned in such courses. The courses must be graduate level and have been taken for graduate credit at the original institution. The credits must not have been used to satisfy the requirements for any other degree. The student is responsible for providing a course description, a course syllabus, an official transcript and other related materials for any potential transfer work to the Graduate Director.

The grades earned in transfer work do not affect the grade point average of the work taken at the University of Maryland, nor do the courses appear on the University of Maryland transcript. The student still needs to take the same total credits at UMCP to graduate with a Ph.D. degree in Bioengineering, but can use additional elective courses at UMCP, or dissertation research credits (BIOE 899) taken at UMCP to satisfy the minimum 45 credits for the Ph.D. program. Advanced special students matriculating within UMCP can transfer up to 12 credits of graduate coursework.

Teaching Requirement

As part of the Ph.D. program's educational requirements, all PhD students must act as Teaching Assistants (TAs) for a minimum of two semesters, preferably during their second year of studies. The assignment of these duties will be made by the Graduate Director. There is no compensation associated with the Teaching Assistantship, as this is an academic requirement.

Laboratory Rotation and Research Advisor Selection Guidelines

- a. Shortly after the first semester begins, there will be a morning/afternoon of research presentations to introduce the students to bioengineering research in the department.
- b. Each student will then be asked to rank five professors. The Graduate Director will assign each student to three rotations from the list.
- c. Students will do three laboratory rotations of about 6 weeks each, starting after Labor Day and ending in March. Specific dates will be provided each academic year.
- d. As part of the lab rotation grade, students are required to attend the Friday Bioengineering Seminars.
- e. Students are welcome but are not required to discuss research opportunities with other faculty members besides those with whom the student rotates.
- f. On March 15 the student will turn in his/her ranked list of three desired research advisors, which may include laboratories that were not among the rotation labs.
- g. By April 1 (or earlier) the student will be notified of the assignment of his/her advisor.

Research Aptitude Exam (RAE)

All students entering the Ph.D. program must take the Research Aptitude Examination held in January, prior to the second semester of their first year. The date and time of the examination will be announced by the graduate program before the end of the Fall semester.

The exam will be distributed electronically and will include multiple problem statements. One problem statement should be chosen. A written proposal and an oral presentation of the chosen problem are required. The objective of the written proposal is to communicate one's vision of how a specific research problem may be investigated. The objective of the oral presentation is to succinctly communicate the key

points of the written proposal. Typically, this would require an introduction that presents the field of research and then a discussion of the experimental plan.

The Examination:

The exam will be distributed electronically and will include multiple problem statements. The student must choose one problem statement to answer and then notify the Graduate Director, via e-mail, of the problem statement s/he is planning to address. Once the Graduate Director has been notified of the problem selection, changes will not be permitted.

A written proposal and an oral presentation must be prepared in response to the problem statement. The written proposal must be submitted electronically to the examination committee. The oral presentation will be delivered to a committee of 3 faculty members. The written copy must include the following University honor pledge typed on the title page under your name: *I pledge on my honor that I have neither given nor received any unauthorized assistance on this examination.* All work must be your own. Do not speak to any fellow students, faculty, or anyone else regarding this exam. Questions should be directed to the Graduate Director only.

Part I: Written Proposal:

The objective of the written proposal is to communicate how a specific research problem may be investigated. The following details delineate the section requirements within the written proposal as well as the purpose of each section:

Abstract: State why the field (your problem) is significant, the objective, and the strategy to solve the specific problem. Typically, an abstract is one page or less in length.

Specific Aims: State a global hypothesis, specific hypotheses, and specific aims which will address the specific hypotheses.

Background and Preliminary Studies: Introduce the fields pertinent to your proposal as well as any preliminary calculations or research results. Depending upon your background and problem, you may or may not discuss preliminary studies.

Research Design and Methods: Outline detailed experiments which will investigate each hypothesis, and therefore each specific aim. Each experiment should contain an objective, experimental plan, and success criterion. The information provided in the experimental plan (or the cited references in the experimental plan) should allow a reader to carry out the proposed plan. Include a methods section, resources required to perform your experimental plan, and a time line. ***The experimental plan is the heart of the proposal.***

Cited References: Cite sources for background information and experimental plan.

The proposal is not to exceed 20 pages using a 12pt font and 1.5 line spacing. The 20 page limitation covers the proposal body text, as well as any figures, tables and schemes. The title page, abstract, and cited references are the only sections that do not count toward the 20 page limitation.

Part II: Oral Presentation:

The objective of the oral presentation is to succinctly communicate the key points of the written proposal. Typically, this would require an introduction that presents the field of research and then a discussion of the experimental plan. *The presentation should not last longer than 30 minutes. This guideline would generally be interpreted to also mean that the presentation should not be longer than 25 slides.* Both during and after the presentation, the committee may ask questions about the proposal, as well as relevant background topics.

Each student will be notified by email of the place and time of the oral presentation. The presentations should be delivered using Microsoft PowerPoint. A laptop computer and LCD projector will be provided on the day of the presentation.

The Committee will evaluate the written proposal and oral presentation with regard to the following categories, which will be assigned a consensus score from 0-4. A minimum total score of 10 out of 20 possible points is considered meeting the requirements for passing the examination.

0=unacceptable; 1= marginally acceptable; 2= acceptable; 3= above average; 4= outstanding

- Manuscript: Logic and Organization
- Manuscript: Mechanics and Clarity
- Manuscript & Oral Presentation: Literature and Background
- Manuscript & Oral Presentation: Feasibility of Proposed Research
- Oral Presentation: Delivery and Answers to Committee Questions

The outcome of the Research Aptitude Exam (RAE) is reported as *pass* or *fail* (no provisional passes are granted, although the committee may mandate courses to correct deficiencies or make other recommendations to the student). If the student fails the first attempt at the exam, s/he can re-take the exam once. If the student fails a second attempt, s/he must leave the Ph.D. program; the student can pursue an M.S. degree at this time. If the student chooses to complete an MS degree, s/he may re-apply for admission to the Ph.D. program, but would be subject to the same admissions policies as other incoming students. If the student is readmitted, s/he must still pass the Research Aptitude Exam to continue in the Ph.D. program.

Dissertation Research Proposal

The objectives of this exercise are to give students some initial experience writing research proposals, to effectively communicate research results, and to allow those interested in an academic career to develop research ideas that could be expanded for future fellowship and job applications. Even if one is not planning an academic career, proposal writing experience is valuable. Almost every Ph.D. scientist in the private sector has to write proposals or research plans for review by supervisors within his/her company. In fact, virtually every industrial scientist we hear from, tells us they wish that they had obtained more writing experience in graduate school. The oral presentation will provide the student with feedback on research ideas, and allows students to gain additional practice in giving short talks and fielding questions on a scientific topic. Everyone has to interview for a job at some point in his/her life. Even after you get a job, you will be asked to make this sort of presentation. Industrial scientists are constantly pitching project ideas to various division directors, vice presidents, etc. Academic scientists obviously do this sort of thing in the classroom and when they give seminars. Those who are comfortable with this presentation format are more likely to have successful careers

The dissertation research proposal consists of a written document and an oral presentation, held after the student successfully passes the Research Aptitude Exam, and after earning a GPA of 3.0 in each of the core courses. The research advisor serves as chair of the PhD proposal committee, which shall consist of a minimum of 3 voting members, all of whom hold a Ph.D., Sc.D., M.D., D.D.S., D.M.D. or equivalent degree. The dissertation proposal committee shall be approved by the Bioengineering Graduate Program Director and shall include at least 2 Bioengineering Graduate Program faculty members, which must have a percentage full-time equivalent appointment in the Fischell Department of Bioengineering. Affiliate and Adjunct faculty do not hold a % FTE appointment in the Fischell Department. The dissertation proposal committee members will normally serve on the final dissertation committee. It is recommended, but not required, that the proposal committee be composed of 5 members and match the composition of the final dissertation committee (see PhD Dissertation defense for composition of this committee). *The Dean's representative is required only at the dissertation defense but must be notified of earlier meetings and may choose to participate at any time.*

The recommended time for the Ph.D. proposal oral examination is within 2 years after successful completion of the first Research Aptitude Exam attempt (2.5 years since matriculation). Students must successfully pass their Ph.D. proposal within 3 years of the first Research Aptitude Exam attempt (3.5

years since matriculation). If a student fails to pass his/her Ph.D. proposal within this time period, the Bioengineering Graduate Program Director may recommend a one-semester extension (maximum 4 years since matriculation). After this one semester extension, admission to the Ph.D. program may be terminated. Extensions to the Ph.D. proposal are not automatic and will only be granted for very extenuating circumstances.

It is the student's responsibility to contact the committee and to arrange the time and place of the examination. When preparing for the Dissertation Proposal oral examination, the candidate must submit written documentation of notification (to include time, place, and location of defense) to the committee at least 5 days before the proposal defense. The student must also send a brief announcement (2-3 sentences) to the Graduate Program Office for distribution to students and faculty at least 5 days before the defense. The dissertation proposal defense is open to anyone and must be advertised; however, the final deliberations are closed to all but the committee members. The student must secure a majority of positive votes to pass. The student may apply for admission to candidacy to the Ph.D. program upon successfully defending his/her Ph.D. proposal.

Dissertation Research Proposal Guidelines:

The candidate must submit a written document to the committee at least 5 business days before the proposal examination. This document shall be prepared with the consultation of the dissertation advisor. The objective of the written proposal is to communicate a vision of how the specific research problem for the candidate's Ph.D. Dissertation will be investigated. This document may be prepared with the consultation of the dissertation advisor. The candidate must submit a copy of the abstract to the Graduate Program Office for distribution at least 5 business days before the proposal defense. The following delineates the details that each section requires within the written proposal, as well as the purpose of each section:

Abstract: State why the field (your problem) is significant, your objective, and your strategy to solve the specific problem. The recommended length of the abstract is no more than 300 words.

Specific Aims: State a global hypothesis, specific hypotheses, and specific aims which will address the specific hypotheses. This section is recommended to be one page in length.

Background and Preliminary Studies: Introduce the fields that are pertinent to your proposal as well as any preliminary calculations or research results.

Research Design and Methods: Outline detailed experiments which will investigate each hypothesis, and therefore each specific aim. Each experiment should contain an objective, experimental plan, and success criterion. The information provided in the experimental plan (or the cited references in the experimental plan) should allow a reader to carry out the proposed plan. Include a methods section, resources required to perform your experimental plan, and a time line. *The experimental plan is the heart of the proposal.*

Cited References: Cite sources for background information and experimental plan

The proposal is not to exceed 30 pages using a 12pt font and 1.5 line spacing. The 30 page limitation covers the proposal body text, as well as any figures, tables and schemes. The title page, abstract, and cited references do not count toward the 30 page limitation.

The time and place of the examination is established by the chair of the committee.

Student presentation.

The proposal examination shall consist of two parts. Part 1 shall be a public presentation by the candidate, covering the main aspects of the research reported in the proposal. The objective of the oral presentation is to succinctly communicate the key points of the written proposal. Typically, this would require an introduction that presents the field of research and then a discussion of the experimental plan. *The presentation should not last longer than 30 minutes. This guideline would generally be interpreted to also mean that the presentation should not be longer than 25 slides.* During Part 1, questions from the audience to the candidate will be permitted. For questions from persons who are not members of the

Examination Committee, the Chair of the Examination Committee shall have discretion to decide whether such questions are germane to the topic of the proposal and how much time shall be allotted for the answers.

Part 2 shall be a formal examination by the Examination Committee. This part shall be open only to the Examination Committee, and other members of the Graduate Faculty. During Part 2, only members of the Examination Committee shall be permitted to ask questions.

Questioning.

The Chair invites questions in turn from each member of the Examining Committee. The questioning may continue as long as the Examining Committee feels that it is necessary and reasonable for the proper examination of the student. The student must have ample opportunity to answer the questions of the Committee.

Conclusion of the proposal examination.

After questioning has been completed, the student and any others who are not members of the Examining Committee are asked to leave the room while the Examining Committee discusses whether or not the written proposal (including its oral presentation) has been satisfactory. The Committee will evaluate the written proposal and oral presentation with regard to the following categories, which will be assigned a consensus score from 0-4. A minimum total score of 10 out of 20 possible points is considered meeting the requirements for decision c listed below.

0=unacceptable; 1= marginally acceptable; 2= acceptable; 3= above average; 4= outstanding

- Manuscript: Logic and Organization
- Manuscript: Mechanics and Clarity
- Manuscript & Oral Presentation: Literature and Background
- Manuscript & Oral Presentation: Originality and Significance
- Manuscript & Oral Presentation: Feasibility of Proposed Research

The Committee has the following alternatives:

- a. To accept the proposal without any recommended changes and sign the Report of the Examining Committee.
- b. To accept the proposal with recommendations for changes and, except for the chair, sign the Report of the Examining Committee. The chair will check the proposal document and, upon his/her approval, sign the Report of the Examining Committee.
- c. To recommend revisions to the proposal document and not sign the Report of the Examining Committee until the student has made the recommended changes and resubmitted the written proposal for the Examining Committee's approval. The Examining Committee members sign the Report of the Examining Committee if they approve the revised proposal.
- d. To recommend revisions and convene a second meeting of the Examining Committee to review the proposal and complete the student's examination.
- e. To rule the proposal document (including its oral presentation) unsatisfactory. In that circumstance, the student fails.

Following the proposal examination, the chair, must inform the student of the outcome of the proposal examination. The Chair and the Examining Committee members sign the Proposal Examination Report indicating which of the above alternatives has been adopted. A copy of this report is to be included in the student's file at the graduate program office, and a copy is to be given to the student.

Passage or failure.

The student passes if one member of the Examining Committee refuses to sign the Report of the Examining Committee, but the other members of the Committee agree to sign, before or after the approval of the recommended changes. Two or more negative votes constitute a failure of the candidate. In cases of failure, the Examining Committee must specify in detail and in writing the nature of the deficiencies in the proposal and/or the oral performance that led to failure. This statement is to be submitted to the Bioengineering Graduate Program Director and the student. A second proposal examination may be permitted if the student is in good standing. A second proposal examination requires the approval of the Bioengineering Graduate Program Director. If the student fails this second examination, or if a second examination is not permitted, the student's admission to the graduate program is terminated. The student may apply for admission to candidacy to the Ph.D. program only upon successfully passing their Ph.D. proposal examination.

Admission to Ph.D. Candidacy

A student must be admitted to candidacy for the Ph.D. degree at least one academic year before the date on which the degree will be conferred. Typically students apply for admission to candidacy after successfully defending their Ph.D. proposal. It is the responsibility of the student to submit his/her application for admission to candidacy when all the requirements for candidacy have been fulfilled. Applications for admission to candidacy are made by the student and submitted to the Bioengineering Graduate Program Office for further action and transmission to the Graduate School. The Application for Admission to Candidacy form, which must be signed by the research advisor and the Program Director, can be found on the Graduate School's website.

Progress Reports

Upon selection of an advisor, expectations regarding the student's academic and professional productivity must be set, including, but not limited to, those regarding the presentation/publication of papers. The expected minimum productivity at the Ph.D. degree level is two refereed archival journal publication submissions, representing original research (not review papers) before the Ph.D. dissertation defense.

At all times, students must maintain reasonable progress toward the degree. This does not mean that experiments must always succeed, but it does mean that students must continue to make an effort toward successful completion of the Ph.D. It is the advisor's and the committee's responsibility to make sure that the student is pursuing a reasonable path, but it is the student's responsibility to help choose the path and to move along it purposefully.

The student will meet with his/her Committee at the Dissertation Research Proposal Exam. There must be at least one post-candidacy meeting before the dissertation is prepared, and in addition at least once every year after the fourth year. These meetings are intended to ensure that adequate progress is being made toward the Ph.D. For each of the post-candidacy meetings, including the dissertation research proposal defense, the student should prepare a 1-2 page written summary and a 10-15 minute PowerPoint presentation of research progress and future directions.

PhD Dissertation

A dissertation or its equivalent is required of all candidates for a doctoral degree. The topic of the dissertation must be approved by the advisor and the dissertation committee. All candidates for the doctoral degree who have advanced to candidacy will be automatically registered for 6 credit hours of Doctoral Dissertation Research (BIOE 899) by the Graduate School per semester. Directions for preparing and submitting dissertations are found in the Graduate Student Academic Handbook (published by the Graduate School). The ability to do independent research must be demonstrated by an original dissertation. A minimum of 18 hours of Thesis/Dissertation Research (BIOE 899) is required.

Final Oral Examination Guidelines

The final oral defense of the dissertation is conducted in front of a committee of the Graduate Faculty. The committee must be approved by the Bioengineering Graduate Program Director and by the Office of the Registrar. The student's research advisor must complete the Nomination of Thesis or Dissertation Committee form no later than 6 weeks prior to the examination. The Graduate Director will recommend the committee to the Office of the Registrar.

It is the student's responsibility to contact the committee and to arrange the time and place of the examination. The members of the Dissertation Examining Committee must receive the complete dissertation at least ten working days before the scheduled Examination. Should the Dissertation Examining Committee deem it reasonable and appropriate, it may require submission of the dissertation more than ten working days in advance of the Examination.

The research advisor serves as chair of the committee, which will consist of a minimum of five voting members, all of whom hold a Ph.D., Sc.D., M.D., D.D.S., D.M.D. or equivalent degree. At least one of the five (the Graduate School Dean's representative) must be a faculty member in a department or Graduate Program at UMCP external to the one in which the student is seeking the degree. The committee must include at least 2 Bioengineering Graduate Program faculty members, who must have a percentage appointment in the Fischell Department of Bioengineering. One or more members of the committee may be persons from other institutions who hold a doctorate and who are distinguished scholars in the field of the dissertation. Any committee members from other institutions need to be first approved by the Faculty of the Fischell Department of Bioengineering.

The Dean designates one member of the committee as his/her representative. The Dean's representative cannot hold an Affiliate or Adjunct appointment in the Fischell Department of Bioengineering. In addition to having the normal responsibility of a faculty examiner, the Dean's Representative has the responsibility of assuring that the examination is conducted according to established procedures. A disagreement over the examination procedures is referred to the Dean's Representative for decision. The Dean of the Graduate School may void any defense not carried out in accordance with the procedures and policies of the Graduate School. In addition, upon recommendation of the Dean's Representative, the Dean may rule an oral defense to be null and void.

An oral defense must be held in University facilities that are readily accessible to all members of the Dissertation Examining Committee and others attending the defense. The chair of the Dissertation Examining Committee selects the time and place for the examination.

Announcements of the date, time, and location of the defense, as well as the candidate's name and the dissertation title shall be disseminated to all faculty and graduate students within the Bioengineering Graduate Program at least five working days prior to the defense. Mass-distribution methods such as email, a faculty/student newsletter, or individual announcements are acceptable. Merely posting a paper notice on a corridor bulletin board will not constitute a sufficient announcement.

Oral defenses must be attended by all members of the student's officially established Dissertation Examining Committee as approved by the Dean of the Graduate School. They are to be physically present in the examination room during the entire examination. Should a last minute change in the constitution of the Dissertation Examining Committee be required, the change must be approved by the Dean of the Graduate School in consultation with the Director of Graduate Studies of the Bioengineering Graduate Program and the chair of the student's Dissertation Examining Committee. The defense must be open to all members of the College Park Graduate Faculty.

Final Oral Examination Procedures

Identification of the Dean's Representative.

The Dean's Representative must be identified at the beginning of the defense.

Student presentation.

The dissertation defense shall consist of two parts. Part 1 shall be a public presentation by the candidate on the main aspects of the research reported in the dissertation. During Part 1, questions from the audience to the candidate will be permitted. For questions from persons who are not members of the Dissertation Examination Committee, the Chair of the Dissertation Examination Committee shall have discretion to decide whether such questions are germane to the topic of the dissertation and how much time shall be allotted for the answers.

Part 2 shall be a formal examination by the Dissertation Examination Committee. This part shall be open only to the Dissertation Examination Committee, and other members of the Graduate Faculty. During Part 2, only members of the Dissertation Examination Committee shall be permitted to ask questions.

Questioning.

The chair invites questions in turn from each member of the Dissertation Examining Committee. The questioning may continue as long as the Dissertation Examining Committee feels that it is necessary and reasonable for the proper examination of the student. The student must have ample opportunity to answer the questions of the Committee.

Conclusion of the defense.

After questioning has been completed, the student and any others who are not members of the Dissertation Examining Committee are asked to leave the room and the Dissertation Examining Committee discusses whether or not the dissertation (including its defense) has been satisfactory. The Committee has the following alternatives:

- a. To accept the dissertation without any recommended changes and sign the Report of the Examining Committee.
- b. To accept the dissertation with recommendations for changes and, except for the chair, sign the Report of the Examining Committee. The chair will check the dissertation and, upon his/her approval, sign the Report of the Examining Committee.
- c. To recommend revisions to the dissertation and not sign the Report of the Examining Committee until the student has made the recommended changes and resubmitted the dissertation for the Dissertation Examining Committee's approval. The Dissertation Examining Committee members sign the Report of the Examining Committee if they approve the revised dissertation.
- d. To recommend revisions and convene a second meeting of the Dissertation Examining Committee to review the dissertation and complete the student's defense.
- e. To rule the dissertation (including its defense) unsatisfactory. In that circumstance, the student fails.

Following the defense, the chair, in the presence of the Dean's Representative, must inform the student of the outcome of the defense. The chair and the Dean's Representative both sign the Oral Defense Report indicating which of the above alternatives has been adopted. A copy of this report is to be included in the student's file at the bioengineering graduate program office, and a copy is to be given to the student.

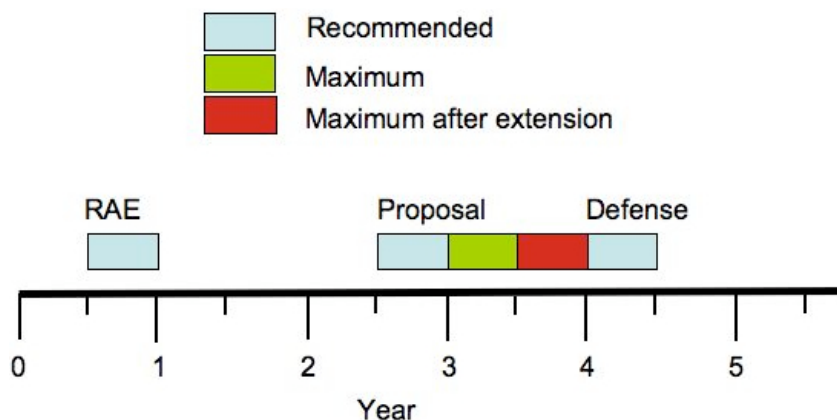
Passage or failure

The student passes if one member of the Dissertation Examining Committee refuses to sign the Report of the Examining Committee, but the other members of the Committee agree to sign, before or after the approval of the recommended changes. *Two or more negative votes constitute a failure of the candidate to meet the dissertation requirement.* In cases of failure, the Dissertation Examining Committee must specify in detail and in writing the nature of the deficiencies in the dissertation and/or the oral performance that led to failure. This statement is to be submitted to the Bioengineering Graduate Program Director, the Dean of the Graduate School and the student. A second defense may be permitted if the student is in good standing at the time of the proposed second defense. A second defense requires the approval of the Bioengineering Graduate Program Director and the Dean of the Graduate School. If

the student fails this second defense, or if a second defense is not permitted, the student's admission to the graduate program is terminated.

Time Limitations

The recommended time for completion of the entire program for the Ph.D. degree, including the dissertation and final examination is within 4.5 years of matriculation. This is accomplished by passing the RAE exam in the winter term of the first year, successfully defending the proposal 2 years later, and defending the dissertation a year and a half after the proposal (see schematic below).



A student's advisor may choose to withdraw financial support from the student after 6 years of matriculation in the Ph.D. program. The maximum time that the graduate school allows students to complete the entire program for the Ph.D. degree, including the dissertation and final examination, is within 4 years after admission to candidacy, or 9 years after admission to the doctoral program, whichever is greater. If a student fails to meet all degree requirements, the Bioengineering Graduate Program may recommend, and the Graduate School may grant, a one-year extension to complete the remainder of the doctoral requirements. After this one year period, enrollment to the Ph.D. program is terminated. A student may apply for readmission to the program. For a re-admitted student, the program may recommend advancement to candidacy following program prerequisites as specified by the program and approved by the Graduate School. For Ph.D. students, a readmission to Ph.D. candidacy shall be for a maximum period of 4 years, unless otherwise specified by the program.

Graduate School Forms

The Graduate School requires all students in the Ph.D. program to submit the following forms to the Office of the Registrar:

1. Application for Admission to Candidacy Form
2. Nomination of Dissertation Committee Form
3. Report of Examining Committee Form
4. Application for Graduation (must be submitted electronically on www.testudo.umd.edu)
5. "Electronic Thesis and Dissertation Publication Form"

See also <http://www.gradschool.umd.edu/etd/>

MS Students should submit the "Approved Program Form"

The student will not be allowed to graduate without having submitted these forms. It is the student's responsibility to complete these forms by the required deadlines. The deadlines for submitting these forms are available from the Graduate School's website.

Masters of Science (MS/MD) Degree Requirements

The MD/MS BIOE program is administered jointly by the School of Medicine (SoM) at the University of Maryland, Baltimore and the Fischell Department of Bioengineering (FDB) at the University of Maryland, College Park. The requirements for a MS degree in bioengineering within the MD/MS BIOE program include 18 credits of courses, and 6 credit hours of thesis research (BIOE 799) as part of a research project. See the PhD requirements for a list of required, restricted and unrestricted elective courses. The MS BIOE degree normally also requires two additional unrestricted electives, which would be satisfied by courses in the MD component of the curriculum.

Summary of MS/MD Requirements:

<i>Courses</i>	<i>Credits</i>
3 Core	9
2 Restricted Electives	6
1 Unrestricted Elective	3
Thesis Research	6
TOTAL	24

Typical Timeline for completion of course requirements:

Fall Semester 1st Year: (10 credits)

- BIOE 601 (3 credits)
- Restricted Elective (3 credits)
- Restricted Elective (3 credits)
- BIOE 799 (1 credit)

Spring Semester 1st Year: (10 credits)

- BIOE 612 (3 credits)
- BIOE 604 (3 credits)
- Unrestricted Elective (3 credits)
- BIOE 799 (1 credit)

Summer Semester 1st Year: (4 credits)

- BIOE 799 (4 credits)

Academic Advising and Registration

The Bioengineering Graduate Program has a mandatory advising policy. The first year of advising is conducted by the Graduate Program Director. At the end of the first year, students are assigned to academic advisors, who will supervise them for the remainder of their graduate studies. When an advisor is assigned, the Projected Course of Study Form is completed by the student in consultation with the academic advisor, who must sign and approve it. The student is then responsible to turn in a copy of this form to the Graduate Office. The Course of Study projects courses and work to be completed during the student's entire course of study. The form only needs to be turned in once, unless changes are made, then the advisor has had to approve these changes.

If the student does not need to take any courses, then registration will be approved for the minimum required 898/899 or 798 credits for full-time status (see below). Registration for any thesis credits beyond the minimum (6 credit hours) needs approval by the academic advisor. *A student will not be cleared for registration until they have turned in a signed Projected Course of Study Form or have notified the Graduate Program Office that they would like to register for courses based on a Projected Courses of Study Form already on file.*

Registration typically begins 3 months before the start of the new semester. The last day to register without financial penalty is the last business day before the first day of classes. Students can register online at <http://www.testudo.umd.edu/>. Graduate students are charged for courses by the credit hour. If the course is dropped the first day of class and/or later, a percentage charge and/or complete charge for the course will be imposed by the University. During the first ten days of classes, students will not be charged to drop and add a course if they are of equal credit value. To avoid additional charges when dropping and adding a course, both the Drop and the Add must be done during the same day. The graduate student is responsible for paying any fees related to adding / dropping courses.

The Graduate School uses a unit system when making calculations to determine full-time or part-time student status. Please note that graduate units are different from credit hours. The number of graduate units per credit hour is calculated in the following manner:

- * Courses in the series: 000-399 carry 2 units per credit hour.
- * Courses in the series: 400-499 carry 4 units per credit hour.
- * Courses in the series: 500-599 carry 5 units per credit hour.
- * Courses in the series: 600-897 carry 6 units per credit hour.
- * Master's Research course: 799 carries 12 units per credit hour.
- * Pre-candidacy Doctoral Research courses: 898 carries 18 units per credit hour.
- * Doctoral Dissertation Research: 899 carries 18 units per credit hour. All doctoral candidates must pay candidacy tuition for which they will be registered for six (6) credit hours of 899; this defines all currently registered doctoral candidates as full-time.

Graduate Assistants holding regular appointments (20 hours) must be registered for 24 units to be considered at full-time status.

Academic Probation

Graduate students are placed on academic probation when their cumulative GPA falls below a 3.0 upon or after completion of 9 credits of graduate courses. If a student's GPA remains below 3.0 for a second consecutive semester, the student will be given a final opportunity to correct their academic deficiency. After a third semester with a GPA below 3.0, the student will not be permitted to reenroll and will be required to withdraw from the program. Since courses can be repeated and the second grade supersedes the first grade, a C can be effectively removed from one's transcript by repeating the course and earning an acceptable (A or B) grade.

Resources for Bioengineering Students

Students in the Bioengineering Graduate Program have a number of resources available to them. The Bioengineering Graduate Program office is available to help with administrative issues (such as registration, processing of fellowship money, etc.). The Graduate Director, Graduate Program Office Staff and Research Advisor are available to provide academic advising and counseling.

The Graduate School also has a number of offices dedicated to supporting graduate students, including the Ombudsperson for Graduates, Graduate Student Government, Graduate Student Legal Aid Office, and many others. Students should contact the Graduate School directly or visit their website for a complete listing of available services.

University services include (but are not limited to) the Office of Information Technology (OIT), University Libraries and Information Services, and the Office of Off-Campus Housing.