



PhD Handbook

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Department of Biomedical Engineering

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1. Introduction

The Ph.D. degree at the USC Alfred E. Mann Biomedical Engineering Department prepares students to become leaders in research, industry, and academia. The goal of the program is to nurture talented minds via research and formal coursework, and to produce future leaders in biomedical engineering. The program accepts students who have completed a four-year Bachelor's degree in a relevant field that allows them to succeed in a graduate program that combines engineering with biological sciences. A Master's degree is not a requirement for entry as applicants with an outstanding bachelors training can also do well in our program. Once admitted to the program, a student must complete a set of requirements to graduate with the Ph.D. degree. These requirements are described next.

2. Unit Requirements

A student is required to complete a total of at least 60 units to obtain the doctoral degree, which includes 16 units from core courses and 44 units of electives (beyond the bachelor's degree, and including the required courses and research units as listed in the requirements below). A student must maintain a minimum overall 3.0 GPA to remain in good academic standing.

3. Course Requirements

Mandatory courses: Each first year student is required to enroll in the lab rotation courses BME 505aL and BME 505bL. The rest of the units can be earned by taking academic core courses relevant to their research. BME PhD students are required to complete 16 units of graduate courses in their first year (excluding BME 533 and 505a) that are pertinent to their research and maintain a cumulative 3.5 GPA or higher in these courses. At least 12 of these units must be taken in the BME Department. Up to 4 units can be taken outside of the BME department. In this case, the student must provide written justification for the external course(s) and submit to the Associate Chair for approval. Thereafter, a student must maintain a minimum overall 3.0 GPA to remain in good academic standing (which considers all courses taken, not just BME courses).

Note: After admission to candidacy upon passing the qualifying exam, the student will enroll in BME-794a, b, c, d, or z instead of BME-790. BME 794a and BME 794b are required to complete the doctoral dissertation defense.

4. Rotations

The purpose of rotations is to properly match students with a Ph.D. advisor and vice versa. There are at most three (3) lab rotations available for students in their first year. However, many students may have already received sponsorship and agreement by a Ph.D. Advisor to join their research lab by the 1st lab rotation (or at the start of the PhD for Research Assistants). With permission of their advisor, a student may do one more rotation to broaden their skill set and/or begin to collaborate with another faculty member who could become part of their dissertation committee. The rotation schedule is as follows:

Week 1 Fall semester: Initial meetings with Faculty/Lab

Weeks 2-8 Fall semester: Lab Rotation #1 (BME 505aL)

Weeks 9-15 Fall semester: Lab Rotation #2* (BME 505aL cont'd)

Weeks 1-7 Spring semester: Lab Rotation #3* (BME 505bL)

*may not be needed if a student has joined a lab, identified a Ph.D. advisor, and received confirmation of sponsorship.

During the rest of the Spring semester of their first year, in addition to research, students will prepare their presentations for the Grodins Symposium (late Spring) and Screening Examination (end of the semester).

5. Ph.D. Advisor and Sponsorship

All students are required to identify a Ph.D. Advisor and join their research lab before the end of their third rotation. A Ph.D. Advisor commits to mentorship and sponsorship of the student during their Ph.D. Before each rotation, students should discuss with the potential Ph.D. Advisor if they are currently looking for Ph.D. students to join their lab and whether they can fund an additional Ph.D. student. It is the critical responsibility of the student to consult with the Biomedical Engineering Department's Graduate Advisor throughout the Rotations period, and

at any time if questions regarding sponsorship by Ph.D. Advisors arise. A student who does not find a Ph.D. Advisor while completing BME 505abL (3 rotations) may, at the discretion of the Biomedical Engineering Department Chair, be allowed to take a 4th lab rotation during their first year. A student who does not find a Ph.D. Advisor by the end of their first year cannot continue in the doctoral program, unless there are extenuating circumstances at which point the student will need to discuss with the Chair, Associate Chair, and/or Graduate Advisor to continue the program.

The Biomedical Engineering Department has a core of primary faculty, and a larger set of courtesy faculty from other departments who are also eligible to be Ph.D. Advisors to students. If the student is doing Rotations or is interested in working with courtesy faculty, it is particularly important to note that it is the responsibility of the student to alert the Graduate Advisor of the Biomedical Engineering Department, and make sure that the courtesy faculty understands the Biomedical Engineering Department's Ph.D. process and regulations, and signs the BME PhD Student Advisor agreement.

6. 1st Year Oral Screening Examination

The Oral Screening Examination is held at the end of the student's first Spring semester in the doctoral program. Students must complete all year-one courses to be eligible to take the Screening Examination. Students who do not satisfy this requirement must consult the Biomedical Engineering Department's Graduate Advisor on how to proceed and could be at risk of having to leave the program.

The Screening Committee, composed of Biomedical Engineering primary faculty, will evaluate the following categories:

- Performance in Biomedical Engineering Core courses (course and class rank in Biomedical Engineering graduate level courses); **a grade of 3.5 (B) or better in all the core courses is required**
- Performance in laboratory rotations BME-505aL and BME-505bL
- Agreement and sponsorship of a Ph.D. Advisor
- Participation in the Grodins Symposium

Passing the Screening Examination is requisite for continuation in the Ph.D. program. In special circumstances, a student may retake the screening procedure at the end of the second year.

7. Biannual Review

Every Fall and Spring semester, the faculty will review each Ph.D. student in the program. This is a rigorous review. Each student must submit a current CV and a list of publications and/or achievements via myViterbi portal. Each student's Ph.D. Advisor will also submit a written statement assessing the student's research and progress. The review, based on these inputs, will result in an evaluation of:

- "At or exceeds expectations",
- "Mostly at expectations and improvements needed" (with a specific list of improvements for each student), or
- "Below expectations" (with a specific list of actions that must be taken).

After the first two semesters, students who do not have a Ph.D. Advisor will automatically receive a "Below expectations" evaluation.

Students must earn a "At or exceeds expectations" or "Mostly at expectations and improvements needed" evaluation on the most recent review before they will be allowed to take the Qualifying Examination or Dissertation Defense.

For each student who earns a "Below expectations" review, the student's Ph.D. Advisor and the Chair or Associate Chair will develop a remediation plan to be completed within 12 months.

Two "Below expectations" reviews (total, not consecutively) or failure to achieve the remediation plan are warranted for removing a student from the Ph.D. program.

8. Teaching Requirement

All Ph.D. students are required to complete the Viterbi TA training prior to the start date of their teaching assistantship assignment. Every Ph.D. student is expected to

TA at least one class during their Ph.D. program. The semester to serve as a TA should be discussed with the student's Ph.D. Advisor. The TA effort can be at 25% or 50% to count as one class.

9. Qualifying Examination

Students are eligible to take the Qualifying Exam when they have earned a minimum of 24 units in residence and maintained an applied minimum 3.0 GPA.

The Qualifying Examination is a proposal to the Qualifying Examination Committee that presents a summary of planned future research to be carried out until graduation, contextualized and justified by work already completed. The Qualifying Examination is expected to be taken in the student's 3rd year (but no later than the end of the 4th year). Thus, the Qualifying Exam should represent a point in which a timeline of steps toward completing the PhD degree can be delineated (e.g. within 12-24 months).

The Qualifying Examination consists of two parts: A written part and an oral presentation. The written part **must** be submitted to the student's Qualifying Examination Committee at least one week (5 business days) before the scheduled oral presentation, or else there is the risk of postponing the oral portion of the exam.

The Qualifying Examination is administered by a Qualifying Examination Committee in person consisting of the Ph.D. advisor and four (4) other faculty members (as described below). The student's Ph.D. Advisor will act as the chair of the committee, unless there is a conflict of interest at which point another committee member or Associate Chair will act as chair of the committee. The Qualifying Examination Committee must include at least three (3) faculty members who have an appointment (primary or courtesy) in the Biomedical Engineering Department. At least one Qualifying Examination Committee member must be a tenured primary faculty in the Biomedical Engineering Department. The Qualifying Examination Committee must also include one tenured/tenure-track USC faculty member (outside member) from any other department whose

primary appointment is not in Biomedical Engineering, and who need not be familiar with the subject matter but serves as an observer. All Qualifying Examination Committees must be approved by the Associate Chair, the Dean's office, and the Graduate School. The Qualifying Examination Committee may include faculty from other universities, in addition to the five members from USC. If a Qualifying Examination Committee member is not faculty at USC, approval for attending over Zoom may be granted by the Associate Chair. The student will work with their Advisor to orchestrate the interactions with the Qualifying Examination Committee Members for a successful completion of the Ph.D.

The student is recommended to meet with the Qualifying Examination Committee at least two months in advance before the Qualifying Examination to introduce themselves and their project.

Students must work with their Ph.D. Advisor to determine the topic and format of the Written portion. One style of paper written in fulfillment of the Written portion of the Qualifying Examination can be selected from these two choices, equivalent to 6-7 pages single spaced text including figures:

1. A research proposal in standard NIH or NSF format.
2. An initial version of their Ph.D. Thesis.

Writing style must be of publishable quality, as determined by the Qualifying Examination Committee, and must include scholarly references (e.g. 30-60).

The Oral presentation of the Qualifying Exam is closed to the public. The Oral presentation of the Qualifying Examination will assess a student's ability to provide a 45-minute presentation on the topic covered in the Written portion, and to show adequate mastery of that topic, reflected both in the technical content of the presentation and the ability to answer questions from the Qualifying Examination Committee.

There are three outcomes of the Qualifying Examination: Pass, Conditional Pass (e.g., edit document, provide additional information), and Fail.

If a student does not pass the Qualifying Examination, they may retake the Examination (that consists of both written and Oral portions) one additional time

as per the same order and timeline above. The student must retake the Oral portion of the Qualifying Examination no sooner than six (6) months and at most twelve (12) months from the initial attempt. Postponement of any part of the Qualifying Examination will be treated on a case-by-case basis by the Associate Chair.

Upon passing the Qualifying Examination, the student and Ph.D. Advisor will convene a Dissertation Committee, as described below, to complete the Ph.D. program.

10. Annual Committee Meeting/Expert Feedback

Students will work with their Ph.D. Advisor to seek out meaningful interactions and feedback from leaders in the field, at least once per year. Preference should be given to their Dissertation Committee members if possible. This will enable students to provide an annual update to their Dissertation Committee members and gain additional perspectives to their research and career development.

11. Ph.D. Dissertation and Defense

A Dissertation (Ph.D. Thesis) involving original research completes the requirements for a Ph.D. degree and includes a written dissertation document and a public oral defense.

The student must provide the complete written dissertation to the committee at least 1 week (5 business days) before the scheduled defense.

The Defense should be announced at least one week in advance. The Defense announcement must include the dissertation title and abstract, the venue, date and time of the Defense, as well as the name of the dissertation.

The dissertation defense committee must have at least three (3) members, of which at least two must have an appointment in Biomedical Engineering, and maximum of five (5) members. The majority of faculty members serving on the

committee must have an appointment in Biomedical Engineering. The student's Ph.D. Advisor will chair the committee, unless an alternate chair has been designated to address conflict of interest. At least one committee member must be tenured in the Biomedical Engineering Department. The committee must also include one tenured (or tenure-track) USC faculty member from another department whose primary appointment is not in Biomedical Engineering. All members of the dissertation defense committee are expected to be present in person. Under extenuating circumstances, approval for attending over Zoom may be granted by the Associate Chair.

12. Time Limits

The dissertation Defense must be completed within eight years of being admitted to the Ph.D. program (six if the student arrives with a BME Master's degree). In rare instances, extensions may be granted (e.g. medical or parental leave).

13. Absences

Doctoral students may be granted a maximum of 4 semesters (not necessarily consecutive) leave-of-absence by the Department Chair, or by a committee appointed by the Department Chair with the approval of the Graduate School. A student who does not return to enrolled status at the end of an approved period of leave is no longer considered to be pursuing a Ph.D. degree and will be removed from the program. All leave-of-absence applications must be submitted to the Biomedical Engineering Department Chair for approval. Please note that withdrawing from all courses in a semester, even if you were once registered for that semester, will count as an absence for that semester even if a leave-of-absence was not requested.

Information about medical leave, which is distinct from a leave-of-absence, can be found [here](#).

14. Transfer Requirements

Students with a USC Biomedical Engineering MS degree may transfer up to 30 units towards their Ph.D. degree. At most 1 course may be substituted for the allowed 500- level or higher courses in the course requirement. Some units taken for a masters degree outside of the USC Biomedical Engineering Department can be used to satisfy some of the Ph.D. units, but this is assessed on a case-by-case basis upon a petition with the support and guidance of their Ph.D. Advisor, and approval of the Associate Chair.

15. Petitioning for MS Degree

After satisfying the Ph.D. course requirements and completing a minimum of 28 units with a GPA of 3.0, a student is eligible to petition for a Master's degree in Biomedical Engineering after they have completed and passed their PhD Qualifying Exam.

16. Existing Students and the new Ph.D. Requirements

These requirements shall apply to all students admitted to the Biomedical Engineering Ph.D. program starting in Fall 2024 or thereafter. Students admitted prior to Fall 2024 may choose to have these requirements applied to them. To do this, the student must submit to the Department an approval letter signed by the student's Ph.D. advisor.

Additional USC policies and information:

<https://catalogue.usc.edu/content.php?catoid=18&navoid=7132>

https://catalogue.usc.edu/preview_program.php?catoid=18&poid=25423