Department of Bioengineering

Master's Student Handbook

Graduate Group in Bioengineering
University of Pennsylvania

Fall 2008

Introduction

Welcome to the Bioengineering Department! This handbook is designed to give new Bioengineering Master's students a brief history and overview of the Bioengineering department at Penn along with important guidelines for successfully completing the Bioengineering Master's program. In addition to this handbook there are helpful resources available on-line;

- The Bioengineering Graduate Program Web Pages: http://www.seas.upenn.edu/be/grad.html
- SEAS Academic Resources: www.seas.upenn.edu/grad/gar.html
- SEAS Graduate Student Handbook: www.seas.upenn.edu/grad/arr.html
- "The PennBook - Resources, Policies & Procedures Handbook": www.vpul.upenn.edu/osl/pennbook.html
- "The Practical Penn: A Student Guide"- an informative handbook distributed to all new students found at: http://dolphin.upenn.edu/~pracpenn/main.html

The Graduate Group Chair, Dr. Susan Margulies, the Bioengineering Master's Program Director, Dr. John Schotland or the Graduate Program Coordinator, Kathleen Venit, can assist you with any special questions or individual concerns not covered in the handbook.

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It is the student's responsibility to be familiar with the rules, procedures, and requirements of the Department, SEAS, and the University of Pennsylvania.

University of Pennsylvania

Founded by Benjamin Franklin in 1740 as a charity school for Philadelphia children, the University of Pennsylvania is one of America's first universities and one of its foremost institutions of higher education. Located in West Philadelphia, Penn offers its students one of the world's best research faculties and a major metropolis rich in history, tradition, culture and innovation.

Today, Penn is a national leader in interdisciplinary programs that combine academic theory with professional practice. Among the Penn programs that cross the traditional boundaries between academic and professional disciplines is the Institute for Medicine and Engineering and the Institute for Translational Medicine and Therapeutics.

Over 10,000 students are enrolled in Penn's 12 graduate and professional schools, many of which are leaders in their fields. Penn is also an integral part of the West Philadelphia community, participating in a number of programs designed to enhance the livability and economic health of the area.

Bioengineering Overview

The first Biomedical Engineering Program in the nation began in the mid 1920's as a collaboration between engineers and health professionals at the University of Pennsylvania. The first Ph.D. in Bioengineering in the United States was awarded from Penn's Bioengineering Graduate Group in 1953. The Department of Bioengineering was formally approved by the University in 1973. Many of Penn's graduates hold academic positions in Biomedical Engineering or related departments at Universities throughout the world, and have played a leading role in defining the field. Other graduates have entered the biomedical industry and have become the primary driving force behind one of the faster growing sectors of the economy in providing advanced biomedical products, which has saved life and improved the quality of our healthcare system.

Today the Bioengineering department at Penn has 16 primary faculty, and more than 50 affiliated graduate group faculty who provide the core teaching and research environment for over 300 undergraduate and 120 graduate students. The department has consistently been ranked as one of the best Bioengineering programs in the country for preparing students for careers in industry, medicine, academia, and other fields related to biomedical technology. The success of the program is due to the dedication of the faculty in conducting both excellent teaching and outstanding research.

Penn's academic curriculum in Bioengineering provides a solid foundation in science and develops powerful methods for understanding basic physiological processes. Combining the resources of the University of Pennsylvania's School of Engineering, School of Medicine, School of Arts and Sciences, School of Veterinary Medicine, School of Dental Medicine, School of Nursing, and the University Hospitals, the department is pioneering in a broad range of research areas in Bioengineering.

Goal and Philosophy

The Master's curriculum provides training in engineering with focuses on biological and medical sciences. The program provides education in scientific and engineering fundamentals and current updates in the field of Bioengineering. The fundamental goal of Penn Bioengineering is to provide students with a broad, flexible curriculum that gives them experience with a wide range of subject areas and intellectual approaches, to prepare them to function creatively and independently in a diverse range of settings.

The Master's degree program meets the need for rigorous and advanced training beyond the typical four-year engineering program. This is a terminal degree program. Students interested in continuing to pursue a Ph.D. must participate in the annual Ph.D. Graduate Admissions process.

Administrative Structure

Main Department Office, Mailboxes and Packages

The Bioengineering Main Department Office is located in 240 Skirkanich Hall. The Graduate Student Mailboxes are stationed in the hallway outside of the Main Department Office. Most mail will be placed into your mailbox; however, you will be asked to pick up any confidential materials directly from the Graduate Program Coordinator in 240 Skirkanich Hall.

All packages should be delivered to the Main Department Office (personal packages are not accepted at the Department Office). If you are expecting a package for your lab please check with the front desk and be sure to sign out for any package you pick up.

Graduate Group Structure

The graduate program in Bioengineering is administered by the Bioengineering Graduate Group under the auspices of the SEAS Associate Dean for Academic Affairs. The Graduate Group is comprised of the Bioengineering primary faculty members as well as faculty from other departments and schools throughout the University. This unique composition gives students the opportunity to work in emerging and interdisciplinary areas that are relevant to Bioengineering. The current members of the BE graduate group and their research areas are listed on the Department's website: http://www.seas.upenn.edu/be/dir/affiliated.html

Advisors

The first person with whom a new student has contact is the Director of the Bioengineering Master's Program. The Director assists each student to develop a program of study for the fall and spring semester of their first year. If the student chooses the thesis option, the student's thesis advisor may provide additional guidance on course selection, and will supervise the student's thesis research. The Director of the Bioengineering Master's Program will provide students assistance with finding a mentor.

The Graduate Environment

The spirit and size of the Department of Bioengineering fosters a close interaction between the graduate students and the entire faculty. This enriches the quality of student-faculty communications and the academic environment to benefit both learning and discovery. Every effort is made to create an environment of scholarship, creativity and learning, which is the very essence of graduate study**.**

Apart from offering advising, seminars, and informal meetings with the Department Chair and Graduate Group Chair to solicit student input and exchange information, the Department strongly supports the Graduate Association of Bioengineers (GABE). GABE (www.seas.upenn.edu/be/gabe/index.html) is a student-run association that represents the entire graduate student community in BE, and organizes both social and professional Bioengineering development events, sometimes in collaboration with the student chapter of BMES (Biomedical Engineering Society, www.bmes.org).

General Information

Penn Bioengineering Graduate Group offers students a broad education that enables them to work, develop, and lead in bioengineering practice and research: within either traditional engineering and research environments, or in non-traditional multidisciplinary environments at the interface between engineering and a diversity of fields, including medicine, the life sciences, business, and law.

Registration, Leave of Absence

Graduate students in Bioengineering have a wide variety of interests, and the BE graduate program is designed to encourage these interests. Some students prefer to take technical courses primarily within the Department; others desire to take a number of courses in other engineering or science departments. All graduate students must complete the "Permit to Register Form". The advisor or Graduate Group Chair must approve of course selection and sign the form to give a student permission to register. Please submit the completed form to the Graduate Program Coordinator's office (240 Skirkanich Hall) for processing. The Graduate Program Coordinator will clear your registration hold within twenty four hours of receiving the form.

This Permit to Register form can be found at:
www.seas.upenn.edu/be/documents/Permittoregisterform.pdf and should be submitted prior to registering for courses. All students should register during Advance Registration. Dates for advance registration for the Spring and Fall semester can be found on the Academic Calendar. The academic calendar is on-line at:
http://www.upenn.edu/almanac/3yearcal.html.

All students enrolled in a degree program are required to be continuously registered. Four graduate course units (CUs) per Fall and Spring semester and one course unit in Summer Session I and II is considered to be a normal, full-time load for all students. Part-time students usually take one or, at most, two courses per semester.

Continuous registration as a graduate student is required unless a formal leave of absence is granted. All students who desire a leave of absence must submit a request to the

Graduate Group Chair. The petition for leave of absence can be found at: www.seas.upenn.edu/forms.

Changes in Registration

Students may add or drop courses without penalty in any semester if it is done by the deadline. The student should discuss all changes in registration with his/her advisor and receive approval before making any changes. Approval should be communicated via email to the Graduate Program Coordinator before making any changes to the registration.

Academic Forms

All Academic Forms including the Petition for Action, Petition for Leave of Absence, Transfer of Credit and Transfer of Graduate Group and the Application for Graduation can be found at www.seas.upenn.edu/forms

Grades, Credits, and Academic Standing

The grading system for graduate courses is A+ through F. If a student receives an F, the course must be taken again; however, the F remains on the student's record. Courses for which a passing grade was obtained cannot be taken again for credit.

Doctoral students in the School of Engineering and Applied Science are expected to maintain at least a B average (3.0) in their work. A student whose record falls below a minimum of a B average will be put on academic probation and may be required to withdraw; graduation requires a minimum of a B average (exclusive of dissertation credits). Requirements cannot be satisfied by auditing courses or receiving an incomplete (I) grade.

Degree Requirements

The Master's degree in Bioengineering is intended to provide students with a solid foundation in the principles of bioengineering as preparation for careers in industry, research and development, government and academia. The program requires 10 course units and offers a Master's thesis option.

Requirements for degree completion: Students must maintain a grade-point average of 3.00 or above and satisfy the following requirements for degree completion:

Thesis Option

1 Math course (1 cu)
2 Biological science courses (Students may select from BE 513, Cell and Molecular Biology (CAMB) courses or Biology courses) (2 cu)
2 Bioengineering graduate electives (must be BE courses) (2 cu)
1 Technical elective course from any science or engineering discipline (1cu)
2 Science and Engineering electives (may be independent study BE 899)
2 Units of thesis research (BE 999) (2 cu) – typically in Summer
10 cu total (all courses must be 500 level or above)

Students will focus on an area of bioengineering that interests them. The Master's Program Director will be available to assist students plan their course of study and guide them in the selection of an advisor who leads their thesis research and to the successful completion of the program. It is expected that the requirements of the program be completed within 12 months.

Non-Thesis Option

1 Math course (1 cu)
2 Biological science courses (Students may select from BE 513, Cell and Molecular Biology (CAMB) courses or Biology courses) (2 cu)
2 Bioengineering graduate electives (must be BE courses) (2 cu)
1 Technical elective course from any science or engineering discipline (1 cu)
4 science and engineering electives of which 2 may be independent study (BE 899) (4 cus)
10 cu total (all courses must be 500 level or above)

Master's Student Course Planning Guide

The Course Planning Guide is very helpful in determining whether or not you have met the requirements of the program. The CPG can be found on-line and on page 11 of this handbook. It is recommended that the CPG be completed and submitted to the Graduate Program Coordinator (240 Skirkanich Hall) each semester during advance registration.

Policy on Transfer Credits Earned in Other Institutions

Two graduate-level course units (out of the 10 required) taken at another university may be accepted provided that the grade received in each course was at least a B and did not count toward an undergraduate degree. All transfer credits are subject to approval by the Graduate Group Chair and the Associate Dean for Academic Affairs. The student who wishes such credit transfer must complete and submit a "Transfer of Credit Petition" found on-line at: www.seas.upenn.edu/forms. In order to obtain credit for courses taken at other institutions the following procedure must be followed:

- For each transfer course, obtain the course description and the title of the textbook prescribed for the course.
- Identify a professor who teaches a similar course at Penn. If a similar course is not offered at Penn, identify a professor whose areas of expertise are in the general area of the course to be transferred. The professor should certify that the course is of similar level to a graduate course offered at Penn or, if a similar course is not offered at Penn, that the course qualifies for Penn students to take if it were offered here.
- Submit a petition on a standard form to the Graduate Group Chair. Attach a copy of the complete transcript to the transfer of credit petition.
- *Please note that a student may not receive credit for a course taken at the undergraduate level if that course counted toward an undergraduate degree.

Independent Study – BE 899

Independent study allows the student to create a customized curriculum to study material beyond or outside the scope of our standard BE offerings. The student should identify the

independent study topic, faculty mentor and scope of the independent study. Prior to the beginning of the semester in which the student contemplates taking the independent study, the student and his/her independent study faculty mentor should develop a brief document. The first paragraph of the document should describe the objectives, scope, and content of the independent study. The second paragraph should state how the independent study will be evaluated and how the student will be graded. The document should be signed by both the student and his/her independent study faculty mentor, and it should be submitted to the graduate group chair for approval before the beginning of the semester.

Independent studies are less structured than regular courses but are no less rigorous. They must adhere to the following guidelines:

- An independent study course should require an effort comparable to that of a regular course, about 9 hours a week or a total of 126 hours per semester.
- The student should meet the faculty member administering the independent study (the advisor) on a regular basis, at least once a week. It is the student's responsibility to schedule these weekly meetings. Past experience indicates that failure to maintain regular contact with the student's advisor often has led to a less than satisfactory performance in the independent-study course. In the absence of regular contact, the student stands the risk of not being focused leading to an impression of dereliction. The key to a successful independent study is a steady effort throughout the semester. The student should not expect to be able to cram a semester's work into a few days of intensive work at the end of the semester.
- At the conclusion of the independent study, the student should prepare a brief report specifying what material was covered during the independent study, those objectives that were met and those that were not. In the event that objectives were

BE 999

BE 999 is the course number assigned to Thesis research. Section numbers for BE 999 are assigned according to each advisor's name. The section numbers for BE 999 will be distributed by the Graduate Program Coordinator during advance registration time period. The student's thesis advisor assigns grades for BE 999. Only grades of "S' (satisfactory), "U" (unsatisfactory) or "I" (incomplete) can be earned in this course.

A Bioengineering Master's student who wishes to write a thesis must choose an advisor and a suitable thesis topic before the end of his/her first semester of graduate studies. The advisor must be a faculty member in the Bioengineering Graduate Group.

At the time of registration for Thesis Research (BE 999), the graduate student must submit a brief written thesis proposal, approved and signed by the advisor and the Director of the Bioengineering Master's program. The proposal should typically contain a statement of the objectives of the work, the scope of the studies, and an outline of the proposed final document. Usually the student will conduct thesis research during the summer sessions but may also do so in the Spring semester.

Submitting the Master's Thesis

The thesis must be prepared and submitted following the University of Pennsylvania Master's Thesis Style Guide found on-line at http://www.upenn.edu/VPGE/Master'ss.html.

The written thesis must be approved by the student's thesis advisor and Bioengineering Graduate Group Chair, indicated by original signatures on the thesis cover page.

Two unbound hardcopies of the approved thesis must be submitted to the Bioengineering Graduate Program Coordinator, 240 Skirkanich Hall. They will be bound (at the BE Graduate Group's expense) for the advisor and the Graduate Group Thesis Library.

Two unbound hard copies of the approved thesis must be submitted to the Office of Academic Programs at the School of Engineering, located in 111 Towne Building, through Betty Gentner.

BE 990 Registration

To be eligible to register for BE 990, a Master's degree student must have completed 10 courses and only need to complete the writing of his/her Master's thesis. Students may also register for BE 990 to allow the completion of any incompletes. A student is allowed to take 990, which carries full-time status with 0 credit units, only once. If a student wishes to register for BE 990, the student must contact the Graduate Coordinator.

Pedagogical Training

Participation of graduate students in the teaching mission of the department develops their teaching, presentation, leadership, and interpersonal skills while assisting the department in discharging its teaching responsibilities. All interested doctoral students are encouraged to participate under faculty guidance in the teaching mission of the department. Students can arrange with the faculty responsible for the course to observe their teaching sessions and comments will be provided to the student. Students may attend seminars emphasizing teaching and communication skills; lead recitations; lead tutorials; supervise undergraduate laboratory experiments; develop instructional laboratories; develop instructional material; and grade homework, laboratory reports, and exams. Penn's Center for Teaching and Learning (www.ctl.sas.upenn.edu) offers workshops and teaching certificates. In addition SEAS teaching training seminar typically will be conducted prior to the first day of class. Students interested in participating in teaching should contact the Graduate Program Coordinator at least one month prior.

Records

The official graduate student records are kept in 111 Towne Building and transcripts can be viewed on Penn InTouch at https://sentry.isc.upenn.edu/intouch/. Graduate students are encouraged to periodically check transcripts. Look for unreported grades or other discrepancies. Please bring any questions or concerns about your transcripts to the attention of the Bioengineering Graduate Program Coordinator in 240 Skirkanich Hall.

Financial Support

It is well known that the cost of a graduate or professional education today is a major investment for most students and their families. The University of Pennsylvania understands this, and is committed to making a Penn education accessible for all talented and qualified students. Extremely limited internal funding opportunities are available for Master's degree candidates. Master's candidates are typically NOT provided fellowship or research support. You should not count on getting financial assistance, beyond loans, if you join our department as a BE Master's student.

For up to date information on financing your graduate education please visit the Student Financial Services web page at: http://www.sfs.upenn.edu/paying/paying-grad.htm Here you will find information on financial aid including loans, scholarships, grants and fellowships.

Graduation Checklist

1) If you have chosen the Master's Thesis option, please obtain Master's thesis instructions from 111 Towne Building, or http://www.upenn.edu/VPGE/MSE.html, early in the writing stage.

2) Confer with your adviser and inform him or her of the need for a timely reading and signature before graduation.

3) Fill out the application form well in advance of the deadline.

4) Make sure that your financial obligations are cleared before the end of the final semester.

5) Check that your academic record is complete, and that appropriate courses have been taken for the degree. Students who have completed all requirements for the degree before their final semester should obtain an exemption from registration form in 111 Towne Building.

6) Order cap and gown from the Bookstore in early March if you wish to participate in the May graduation ceremony. May is the only formal graduation ceremony. (Students who graduate in August or December of the preceding year are invited to attend the May ceremony. Students anticipating graduation in the same year may request, by approval, to participate in the May ceremony.)

Bioengineering Master's Program CPG

Bioengineering Master's Program **Name: _____**

Course Planning Guide **Email:_____**

Thesis Option

Course	Term/ Year	CUs	
		1	1 Math course
		1	2 Biological science courses (Students may select from BE 513, CAMB courses or Biology courses)
		1	
		1	2 Bioengineering Graduate Elective *** must be BE courses**
		1	
		1	1 Technical Elective
		1	2 Units of Science and Engineering Electives *These 2 units may be Independent Study, BE 899
		1	
		1	2 Units of Master's Thesis Research , BE 999
		1	
	Total:	10	

Non-Thesis Option

Course	Term/ Year	CUs	
		1	1 Math course
		1	2 Biological science courses (Students may select from BE 513, CAMB courses or Biology courses)
		1	
		1	2 Bioengineering Graduate Elective ***must be BE courses**
		1	
		1	1 Technical Elective
		1	4 Science and engineering electives *Two of these science and engineering electives may be independent study BE 899
		1	
		1	
		1	
	Total:	10	

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Student's Signature **Susan Margulies, Ph.D.**
Bioengineering Graduate Group Chair