Biomedical Science, PhD (Boston)

The Department of Pharmaceutical Sciences offers a PhD program in biomedical science that focuses on the cross-disciplinary integration of human (patho)biology with drug action, invention, and clinical utility. The biomedical sciences curriculum involves coursework and original research in areas including drug design and profiling, toxicology, and pharmaceutical biochemistry/cell biology aimed at increasing our understanding of how unsolved medical needs may be addressed by novel therapeutic approaches. The biomedical science program is appropriate for those entering the field as well as persons currently employed as research technicians, clinical laboratory workers, and science teachers/administrators. The flexibility of the biomedical science program and its interdisciplinary nature can enhance job performance in a present position and invite new employment opportunities.

Journal Club Participation

The Department of Pharmaceutical Sciences sponsors weekly journal clubs, Pharmaceutical Science Seminar (PHSC 6300), at which students present and evaluate current scientific literature in their fields of study. Students must attend one of these journal clubs (Pharmaceutics & Drug Delivery Journal Club, Pharmacology Journal Club, or Medicinal Chemistry & Drug Discovery Journal Club), chosen in consultation with their advisors.

Attendance at one of these journal clubs is required each and every academic semester, as an integral part of the PhD curriculum, with the exception of the last year (year four) in the program. All PhD students must participate full-time in journal club for course credit, Pharmaceutical Science Seminar (PHSC 6300), for six semesters. Failure to attend journal club regularly may result in sanctions such as probation or dismissal from the PhD program. Any student who does not comply with these (or any other) conditions required in the PhD program faces potential dismissal.

Colloquium Attendance

All PhD students, regardless of program, are required to attend the weekly Pharmaceutical Science Colloquium series. Announcements of times and locations will be distributed weekly to students by email to their university email addresses. Attendance is recorded by sign-up sheet. One excused absence is permitted per semester. Failure to attend colloquia may result in sanctions such as probation or dismissal from the PhD program.

Internship Requirements and Regulations for Department of Pharmaceutical Sciences

Internships provide an experiential component of the graduate curriculum that fosters professional development through work in the pharmaceutical and biotechnology industries.

After PhD candidates have completed their dissertation research and are working on their dissertations, they are able, with the express permission of their PhD advisor, to participate in an internship if they choose. They are never allowed to intern while they are serving as teaching assistants.

1. Students are responsible for finding their own internship and must be honest and accurate representing their experiences on their resumés. Students are responsible for tracking this experience on their resumés as there will be no detailed record on students' transcripts of these opportunities.
2. In order to be eligible for internship, students must take Professional Development for Pharmaceutical Sciences (PHSC 5305) a semester before internship.
3. Students must not accept more than one position. They must honor the first offer accepted. Any student not adhering to this requirement will not be allowed to participate.
4. International students must register for Pharmaceutical Science Internship (PHSC 6401) and follow instructions to receive Curricular Practical Training authorization from the Office of Global Services (https://international.northeastern.edu/ogs/) every semester they work. This applies to part-time jobs and volunteer opportunities. International students cannot engage in full-time CPT authorization totaling more than 52 weeks. Doing so will eliminate the possibility of engaging in the postgraduation benefit of Post-Completion Optional Practical Training.
5. In order to receive a grade for the course, students must write at least two learning goals within the first two weeks of the internship and a one- to two-page paper describing what they learned, mid- and end of semester. Supervisors for internships will reply to a questionnaire about students' performance.
6. Taking internship must not extend international students' visas.
7. There are no vacations on internships. Companies' sick time policies may vary. Students should check with their employers. For all other matters, please see the Universitywide Academic Policies and Procedures (https://catalog.northeastern.edu/graduate/academic-policies-procedures/) and/or Bouvé College of Health Sciences Academic Policies and Procedures (https://catalog.northeastern.edu/graduate/health-sciences/academic-policies-procedures/).

Milestones

QUALIFYING EXAMINATION

The PhD qualifying examination is required for students in all four programs under the auspices of the Department of Pharmaceutical Sciences: pharmacology, medicinal chemistry and drug discovery, biomedical sciences, and pharmaceutics and drug delivery. Students from each of the four programs will take the exams within the same time frame (below), regardless of specialty-area program focus.

Doctoral students should have selected a dissertation advisor by the end of their first year in the program and are expected to have begun research and demonstrated initial proficiency in the laboratory before taking the PhD qualifying examination.

The PhD qualifying examination tests the candidates' knowledge and skills in core courses and program content areas. The overall PhD qualifying examination consists of two written exams and one oral exam. The qualifying examination is taken as a course, Doctoral Training and Research (PHSC 8940), no later than during the fall semester of the student's second year, after having successfully completed all the core courses of their respective programs.

At least two departmental faculty will contribute questions for the written exams, and no one faculty member will write more than the equivalent of one entire exam. All students qualified to sit for the exams are expected to take them at the times announced.

The format for the written exams may vary (e.g., faculty may ask a series of comprehensive essay questions or provide research publications(s) from the biomedical literature and ask questions based upon the publications' content). The first exam is given in the first week of fall semester, with the written portion of the second exam (i.e., the F31 written document) to be submitted to the student's exam committee by the end of October, with the oral presentation to be completed by mid-November and graded by the providers of the question(s).

- ***Written exam 1*** reflects students' knowledge of their specialty-area program material and of overall pharmaceutical sciences. This exam is given on the same day in two parts. Part 1 is focused on each student's specialty-area program focus. Part 2 will test students' overall knowledge in another program focus covered by the pharmaceutical sciences curriculum.
    - For example, if the student is in the pharmaceutics and drug delivery PhD program, part 1 will be about pharmaceutics and drug delivery, and part 2 can focus either on pharmacology or medicinal chemistry and drug discovery.
- ***Written exam 2*** requires that students write an NIH F31 grant proposal and have the proposal signed off as passing by their examination committee after an oral defense.

A score of at least 70% is required to pass the first written exam (two parts). Students must pass all written portions of the PhD qualifying examination prior to the oral defense of the F31 proposal. Students who fail one written exam will have one opportunity to retake and pass that examination. A student who fails the first exam twice will be required to withdraw from the PhD program.

During the oral exam, students defend their NIH F31 grant proposal before an examination committee of, minimally, four faculty members: the dissertation advisor, at least two other Department of Pharmaceutical Sciences faculty members, and at least one member from outside the department. This committee is convened only for the oral exam and does not need to be the same committee as the student's dissertation committee.

Members of the oral examination committee are selected by the student, after consultation with the dissertation advisor and/or the director of graduate studies. The oral exam is graded on a satisfactory/unsatisfactory basis. Students who fail the oral exam on the first attempt may retake the exam within a time period designated by the examination committee not to exceed two months from the first oral exam. Those who fail twice will be dismissed from the program.

DOCTORAL CANDIDACY STATUS

Doctoral students who have completed satisfactorily and thereby earned the credits for all required core courses (including those for their specialized area) and who have passed the written and oral qualifying examinations shall be admitted to candidacy status for the PhD degree.

DOCTORAL DISSERTATION COMMITTEE

Doctoral students must complete a dissertation that embodies the results of extended research and makes an original contribution to their field. This work should give evidence of candidates' abilities to conduct independent investigation and interpret the results of their research in a professional manner. The doctoral dissertation advisor serves as chairperson of the Doctoral Dissertation Committee, which consists of no fewer than five members. Selection of an advisor is by mutual consent of the student and a member of the faculty, with approval by the director of graduate studies in the Department of Pharmaceutical Sciences. At least two members of the Doctoral Dissertation Committee must be faculty members in the Department of Pharmaceutical Sciences. At least one member is to be selected from outside the department. Committee members are chosen for their expertise in students' research areas.

DISSERTATION PROPOSAL DEFENSE

Within a year after successful completion of the PhD qualifying examination, but no later than the beginning of the fall semester of the third year, students must prepare and defend a written proposal detailing their planned dissertation project. Failure to do so will be regarded as a failure to progress in the PhD program and will result in a warning from the director of graduate studies of the Department of Pharmaceutical Sciences.

Students who do not correct this deficiency within one semester will be placed on academic probation. Students on academic probation must complete the dissertation proposal defense and return to nonprobationary status within one semester or be dismissed from the PhD program.

The dissertation proposal should be no more than 50 double-spaced pages (12-point font minimum and one-half-inch margins on all sides). This page limit excludes references but includes figures, figure legends, and tables. Aside from these exceptions, the proposal should otherwise conform to the format and structure of an NIH grant proposal with four main sections: specific aims, background and significance, preliminary studies, and experimental design and methods. The Department of Pharmaceutical Sciences "Dissertation Proposal" document provides detailed instructions on the preparation of a dissertation proposal. Associated required forms may be found in the School of Pharmacy and Pharmaceutical Sciences Student Portal on Canvas in the module section.

The dissertation proposal must be defended orally before the student's dissertation committee and signed by all dissertation committee members in *approval of the student's planned dissertation research.* Upon dissertation approval, the committee must sign the proposal approval cover sheet (https://app.smartsheet.com/b/form/bd964901f0324ef4981d1673ab45b4c9/), which is automatically submitted to the department's director of graduate studies and to the Bouvé College of Health Sciences Graduate Office.

BIANNUAL REVIEW

Dissertation committees meet routinely at six-month intervals, but no less than once a year, to evaluate students' research progress and to be presented with written and oral progress reports on the direction and status of the research. Progress reports should be written in a brief format, identical to that described for the formal dissertation (see instructions listed on the SOPPS Student Portal Canvas site). Unsatisfactory productivity provides the basis for a warning by the dissertation committee and/or the Graduate Committee. Two such warnings will result in a student's dismissal from the program.

Registration for Dissertation

Advisor consent and completion of all coursework (with the exception of the colloquium course) must be documented before students register for the first dissertation course. Students must register for Dissertation Term 1 (PHSC 9990) and Dissertation Term 2 (PHSC 9991). Students must register for Dissertation Continuation (PHSC 9996) each semester thereafter until the dissertation has been successfully defended. The department strongly encourages PhD students to complete the program within five years after acceptance, i.e., by three years after establishing degree candidacy. According to university policy, no PhD students may remain in the program for more than seven years.

Publications and Presentations

Prior to completion of PhD training, candidates must present their research either as a poster or podium presentation at a regional or national scientific conference. Also prior to completion, the student must have submitted (preferably, published) at least one manuscript in a peer-reviewed journal that reflects original findings and laboratory work from the candidate's dissertation research.

PhD Dissertation Preparation

Detailed guidelines for the format and content of the written dissertation are given in Instructions for Preparation of the Dissertation found on the SOPPS Student Portal Canvas site. The completed dissertation document should be reviewed first by the dissertation advisor. Feedback from the advisor should be incorporated into the dissertation draft before its distribution to the dissertation committee. The completed dissertation should be delivered to all dissertation committee members no later than two weeks before the scheduled oral defense.

PHARMACEUTICAL SCIENCES COLLOQUIUM

All PhD candidates nearing completion of their research are required to present their dissertation findings at the department's Pharmaceutical Sciences Colloquium. These presentations should be scheduled at least six months before anticipated completion of the dissertation. In turn, the dissertation should be completed no later than one year after the colloquium presentation. Students must register for Pharmaceutical Science Colloquium (PHSC 6810) during the semester that the colloquium presentation is to be given.

ORAL DISSERTATION DEFENSE

The oral dissertation defense takes place after students complete their PhD dissertation research and all other requirements for the PhD degree. The oral defense deals with the subject matter of the dissertation, significant developments in the field, and students' background knowledge in their field of concentration.

The dissertation committee conducts the final defense. The committee may recommend that the student clarify, amplify, or rewrite portions of the dissertation *before the final defense is scheduled.* Once the committee concurs that that written dissertation document is acceptable, a date is chosen for the final oral examination.

At least two weeks prior to the defense, students should inform the director of graduate studies in the Department of Pharmaceutical Sciences of the date of defense, so that advance announcement may be distributed. The final defense is open to anyone who wishes to attend and typically lasts at least two hours. After presentation of the work by the student in a seminar format, and responses to audience and committee questions, the committee meets first with the student for any follow-up discussion and then in executive session to decide whether the student has defended the dissertation successfully.

The committee's decision is then announced to the student. If the committee's vote is favorable, the student incorporates committee suggestions and corrections, if applicable, and the dissertation is signed and passed on to the department's director of graduate studies. Requests for a second defense are highly irregular but may be permitted in the event that the previous oral defense was judged by the committee to be highly promising but inadequate in one critical aspect.

Deadline

The final dissertation must be written, defended, and approved at least two weeks before the university commencement deadline. Students must submit signed copies of their dissertations to the website designated by the university and must abide by any embargo sanctioned by the student's principal dissertation advisor and/or dissertation committee. The students should apply for graduation before the final dissertation defense, on the assumption that the dissertation will be approved. If the dissertation committee decides that more time is required to complete the dissertation beyond the commencement date, then the application for graduation can be withdrawn and a new one submitted pending final dissertation approval.

SOPPS CODE OF PROFESSIONAL CONDUCT

All SOPPS students (BSPS, Preprofessional, MS, and PhD) are expected to adhere to the Code of Professional Conduct (https://bouve.northeastern.edu/assets/uploads/sites/5/2021/10/northeastern-school-of-pharmacy-code-of-professional-conduct-2021.pdf).

Please visit Bouvé College of Health Sciences Program Learning Outcomes (https://bouve.northeastern.edu/learning-outcomes/) for the specific student learning outcomes for this program.

Program Requirements

Complete all courses and requirements listed below unless otherwise indicated.

Milestones

Qualifying examination
Doctoral candidacy status
Doctoral dissertation committee
Dissertation proposal
Biannual review
Pharmaceutical Sciences Colloquium
Oral dissertation defense

Core Requirements

A grade of C– or higher is required in each course.

Code	Title	Hours
Seminar		
Complete the following repeatable course for six semesters:		6
PHSC 6300	Pharmaceutical Science Seminar	
Required Core		
Complete the following:		
PHSC 5100	Concepts in Pharmaceutical Science	2
PHSC 5102	Concepts in Pharmaceutical Science 2	2
PHSC 5212	Research Skills and Ethics	2
PHSC 5305	Professional Development for Pharmaceutical Sciences	1
PHSC 6213	Ethical Problems in Health Sciences Research	2
PHSC 6214	Experimental Design and Biostatistics	2

Electives

Code	Title	Hours
Students must complete one course from each of the following specialization areas for a total of three courses:		8-10
Pharmaceutics & Drug Delivery		
Complete one of the following:		
PMST 6250	Advanced Physical Pharmacy	
PMST 6252	Pharmacokinetics and Drug Metabolism	
PMST 6254	Advanced Drug Delivery Systems	
Pharmacology		
Complete one of the following:		
PMCL 6250	Ion Channel Physiology and Pharmacology	
PMCL 6252	Small-Molecule Target and Ligand Pharmacology	
Medicinal Chemistry & Drug Discovery		
Complete one of the following:		
CHEM 5626	Organic Synthesis 1	
CHEM 5628	Principles of Spectroscopy of Organic Compounds	
PHSC 5450	Contemporary Approaches to Drug Design	

Research and Dissertation

Code	Title	Hours
Prequalifying Exam Course		
PHSC 7020	Scientific Writing: Thesis Proposal	2
Qualifying Exam		
PHSC 8940	Doctoral Training and Research	1
Proposal Preparation		
PHSC 9681	Doctoral Proposal	2
Dissertation		
PHSC 9990	Dissertation Term 1	

PHSC 9991	Dissertation Term 2	
Colloquium		
PHSC 6810	Pharmaceutical Science Colloquium	1

Program Credit/GPA Requirements

31 - 33 total semester hours required
Minimum 3.000 GPA required

Plan of Study (Standard Program)

Sample Plan

Year 1

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
PHSC 6300	1	PHSC 5212	2	PHSC 7020[1]	2
PHSC 5100	2	PHSC 6214	2		
PHSC 5102	2	PHSC 6300	1		
During the first year of courses, students must complete one course for each specialization:	3-6	During the first year of courses, students must complete one course for each specialization:	2-7		
Available in Fall semester:		Available in Spring semester:			
Pharmaceutics & Drug Delivery:		Pharmaceutics & Drug Delivery:			
PMST 6254		PMST 6250 or 6252			
Pharmacology:		Pharmacology:			
PMCL 6250		PMCL 6252			
Medicinal Chemistry & Drug Discovery:		Medicinal Chemistry & Drug Discovery:			
CHEM 5626 or 5628		PHSC 5450			
	10-11		**8-12**		**2**

Year 2

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
PHSC 6300	1	PHSC 6300	1	PHSC 9681[2]	2
PHSC 8940	1	PHSC 8986	0		
	2		**1**		**2**

Year 3

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
PHSC 6300	1	PHSC 6300	1	PHSC 9996	0
PHSC 9990	0	PHSC 9991	0		
	1		**1**		**0**

Year 4

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
PHSC 5305[4]	1	PHSC 6213[4]	2	PHSC 9996	0
PHSC 6810[3]	1	PHSC 9996	0		
	2		**2**		**0**

Total Hours: 31-36

1 Scientific Writing: Thesis Proposal (PHSC 7020) must be taken the summer before the qualifying exams.
2 Doctoral Proposal (PHSC 9681) should be taken in summer of second year, but no later than fall of third year.
3 Pharmaceutical Science Colloquium (PHSC 6810) must be taken six months before dissertation defense.
4 PHSC 5305 & PHSC 6213 is suggested to be taken in the fourth year, but can be taken at any point before graduation.

Sample Plan of Study - Advanced Entry

Year 1

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
PHSC 6300	1	PHSC 6300	1	PHSC 9681[1]	2
PHSC 8940	1	PHSC 8986 or 9681[1]	0		
	2		**1**		**2**

Year 2

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
PHSC 6300	1	PHSC 6300	1	PHSC 9996	0
PHSC 9990	0	PHSC 9991	0		
	1		**1**		**0**

Year 3

Fall	Hours	Spring	Hours
PHSC 6810[2]	1	PHSC 6213	2
		PHSC 9996	0
	1		**2**

Total Hours: 10

1 Doctoral Proposal (PHSC 9681 (https://catalog.northeastern.edu/search/?P=PHSC%209681)) may be taken in spring of the first year but must be taken before fall of the second year.

2 Pharmaceutical Science Colloquium (PHSC 6810 (https://catalog.northeastern.edu/search/?P=PHSC%206810)) must be taken six months before the dissertation defense.

Advanced Entry Program Requirements

Advanced entry into the PhD program in biomedical science requires a master's degree in pharmaceutical sciences or a related area and focuses on various advanced research courses, and successful defense of the dissertation. . An applicant's transcripts are required to be reviewed by the admissions committee to ensure they are eligible to be in the advanced entry program.

Complete all courses and requirements listed below unless otherwise indicated.

Milestones

Annual review
Qualifying examination
Dissertation committee
Dissertation proposal
Dissertation defense

Core Requirements

A grade of C– or higher is required in each course.

Code	Title	Hours
Required		
PHSC 6213	Ethical Problems in Health Sciences Research	2
Seminar		
Complete the following repeatable course four times:		4
PHSC 6300	Pharmaceutical Science Seminar	
Colloquium		
PHSC 6810	Pharmaceutical Science Colloquium	1

Research and Dissertation

Code	Title	Hours
Qualifying Examination		
PHSC 8940	Doctoral Training and Research	1
Proposal Preparation		
PHSC 9681	Doctoral Proposal	2
Dissertation		

PHSC 9990	Dissertation Term 1
PHSC 9991	Dissertation Term 2

Program Credit/GPA Requirements

10 total semester hours required
Minimum 3.000 GPA required

Plan of Study (Advanced Entry)

Sample Plan of Study - Advanced Entry

Year 1

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
PHSC 6300	1	PHSC 6300	1	PHSC 9681[1]	2
PHSC 8940	1	PHSC 8986 or 9681[1]	0		
	2		**1**		**2**

Year 2

Fall	Hours	Spring	Hours	Summer Full Semester	Hours
PHSC 6300	1	PHSC 6300	1	PHSC 9996	0
PHSC 9990	0	PHSC 9991	0		
	1		**1**		**0**

Year 3

Fall	Hours	Spring	Hours
PHSC 6810[2]	1	PHSC 6213	2
		PHSC 9996	0
	1		**2**

Total Hours: 10

1 Doctoral Proposal (PHSC 9681 (https://catalog.northeastern.edu/search/?P=PHSC%209681)) may be taken in spring of the first year but must be taken before fall of the second year.

2 Pharmaceutical Science Colloquium (PHSC 6810 (https://catalog.northeastern.edu/search/?P=PHSC%206810)) must be taken six months before the dissertation defense.