

PHARMACEUTICAL SCIENCES (MS, PHD)

The School of Pharmacy's Program in Pharmaceutical Sciences offers graduate degrees in three areas of concentration:

- Medicinal and Natural Products Chemistry
- Pharmacology/Toxicology
- Pharmaceutics

Medicinal and Natural Products Chemistry

The Division of Medicinal and Natural Products Chemistry in the Department of Pharmaceutical Sciences offers a Ph.D. in Medicinal and Natural Products Chemistry. The Division also offers a Master of Science (M.S.) degree in Medicinal and Natural Products Chemistry; however, the Division does not admit students to the University for the specific purpose of earning an M.S. degree. The Ph.D. program in Medicinal and Natural Products Chemistry is focused on research and education in all areas of drug discovery and development. The program prepares students for a wide-range of careers in academics, industry, and government. The M.S. and Ph.D. degrees in Medicinal and Natural Products Chemistry require a defined set of core courses, related area courses, electives, and research as outlined below.

M.S./Ph.D. Core Requirements

Course	Title	Credits
GRAD 5910	Responsible Conduct in Research	1
PHAR 5297	Special Topics in Pharmaceutics	1-6
PHAR 5301	Macromolecules in Drug Design	2
PHAR 5302	Chemical Biology and Drug Design	2
PHAR 5303	Small Molecule Structure and Function	2

Seminar Requirement

Ph.D. students are required to enroll in PHAR 5393 Seminar in Medicinal Chemistry for a minimum of six credits. M.S. students are required to enroll in PHAR 5393 Seminar in Medicinal Chemistry for a minimum of four credits. Each student will register for PHAR 5393 Seminar in Medicinal Chemistry each semester and is expected to attend all Medicinal and Natural Products Chemistry and Pharmaceutical Sciences Departmental seminars. Each student will present a seminar once per year.

Elective Requirement

Ph.D. students are required to complete at least 11 credits of elective coursework. The elective coursework can be from the Department of Pharmaceutical Sciences or from an area related to Medicinal and Natural Products Chemistry. Courses are chosen by the student in consultation with their dissertation advisor. This requirement may be waived for students with a prior Master's degree in a related area. M.S. students must meet the requirements of the UConn Graduate School in regards to total credit hours earned. These credits can be earned through coursework or lab research.

Research Requirement

Ph.D. students are required to take a minimum of 15 credits of GRAD 6950 Doctoral Dissertation Research.

Advancement to Candidacy

There are two requirements for advancement to doctoral candidacy: passing the general examination and satisfying a third year progress review.

Dissertation Proposal

Submission of the dissertation proposal is required for Ph.D. students by the end of the second semester of the third year.

Pharmacology and Toxicology

The Division of Pharmacology and Toxicology is one of the three core disciplines within the Department of Pharmaceutical Sciences. Scholarly laboratory research and the education of graduate students in all aspects of drug and chemical action are paramount activities of the pharmacology and toxicology faculty. Therapeutic and toxic reactions to drugs and chemicals and their physiological and biochemical mechanisms of action are emphasized in this program. Emphasis is also placed in the areas of biochemical toxicology, inhalation toxicology, molecular toxicology, molecular pharmacology of nuclear receptors, hepatotoxicology, and immunology. The Division of Pharmacology and Toxicology grants Ph.D. degrees under two tracks: Pharmacology and Toxicology. The course and scholarly requirements for the Ph.D. degree are described in detail below. In addition, the Division offers a thesis-based master's degree, which requires 30 credits in total, to include at least 21 credits of advanced graduate coursework.

Requirements

Students pursuing the Ph.D. or M.S. degrees offered within the Division of Pharmacology and Toxicology must meet all requirements as stipulated by the Department of Pharmaceutical Sciences and the University of Connecticut Graduate School. Requirements for graduate studies in the Discipline of Pharmacology and Toxicology are summarized below.

Core Requirements

The following courses must be completed by all doctoral and master's graduate students enrolled in the Division of Pharmacology and Toxicology:

Course	Title	Credits
GRAD 5910	Responsible Conduct in Research	1
PHAR 5403	Current Literature in Pharmaceutical Sciences ¹	1
PHAR 5297	Special Topics in Pharmaceutics	1-6
PHAR 5454	Principles of Safety Evaluation	1
PHAR 5471	Advanced Pharmacology I: Basic Principles	3
PHAR 5472	Advanced Pharmacology II: Drug Disposition	2
PNB 5302	²	3

¹ Must be taken twice, ordinarily in first and second years.

² This course may be waived for students who have received an M.D., D.V.M., or Pharm.D. degree from an accredited U.S. institution. Students with a B.S. degree in Pharmacology and Toxicology and/or relevant course work from a U.S. institution may receive a comparable waiver.

Research Requirement

Plan A M.S. students are required to take a minimum of nine credits of GRAD 5950 Master's Thesis Research. Ph.D. students are required to take a minimum of 15 credits of GRAD 6950 Doctoral Dissertation Research.

Additional Core Requirement for Toxicology Track

Course	Title	Credits
PHAR 6455	Advanced Toxicology	4
PATH 3100	Histologic Structure and Function	4

Seminar Requirement

Two to four credits of PHAR 5475 Toxicology Scholars Colloquium and PHAR 5493 Seminar in Pharmacology and Toxicology. Seminars meet on a regular schedule, weekly or as announced, throughout the academic year and are required of all students. Students are expected to attend and to present seminars in every year of their graduate program. Up to four credits of seminar may be earned toward the Ph.D. PHAR 5493 Seminar in Pharmacology and Toxicology is required for all students.

Pharmacology/Toxicology Electives

Each faculty member offers one or more specialty courses in their area of research specialization. Each graduate student in a Ph.D. program will take at least two of these specialty courses, one of the courses being given by faculty other than the student's major advisor, totaling four credits.

Special Topics Electives

Special topics elective courses are offered from time to time for variable credit by special arrangement with the faculty to provide a means to cover new topics not otherwise available in the regularly scheduled courses. These courses may be repeated for credit, as long as the content is not repeated.

Statistics Requirement

Students must complete a three credit graduate level course in statistics. Ordinarily this requirement will be met by completing a course in the Statistics Department. STAT 5605 Applied Statistics II, BIST 5625 Introduction to Biostatistics, or ANSC 5601 Experimental Design in Animal Science are statistic courses taken most commonly by graduate students in the program.

Biochemistry Electives

All Ph.D. students will complete electives from other departments on campus, with at least six credits in courses with significant biochemistry content. This requirement is typically met by courses offered through Molecular and Cell Biology and/or Biology or Chemistry Departments. MCB 5217 Biosynthesis of Nucleic Acids and Proteins, MCB 5280 Advanced Cell Biology, and MCB 5427 Laboratory Techniques in Functional Genomics are recommended.

Academic Standards

All graduate students in the Pharmacology/Toxicology program are expected to achieve a grade of "B" or better in all core courses. A grade below "B" in one or more core courses may subject the student to dismissal from the program.

Qualifying Examination

A written qualifying examination covering comprehensive content in Pharmacology must be passed by all doctoral and master's students.

General Examination in Pharmacology/Toxicology

A general examination is required for doctoral, but not master's students.

Publications

Ordinarily, it is expected that each student will have one or more publications accepted and one or more publications submitted at the time of the Ph.D. dissertation defense.

Pharmaceutics

Pharmaceutics is a highly multi-disciplinary field requiring expertise in chemistry, engineering, pharmacy, materials science, mathematics, and the biological sciences. The area of research ranges from fundamental studies of the physicochemical properties of drugs and related molecules to dosage forms and delivery systems. The Division of Pharmaceutics in the Department of Pharmaceutical Sciences offers the Doctor of Philosophy (Ph.D.) in Pharmaceutics. The Division also offers a Master of Science (M.S.) degree in Pharmaceutics; however, the Division does not admit students to the University for the specific purpose of earning an M.S. degree. Students may obtain an M.S. degree and must meet the Graduate School minimum requirements, including 30 credits approved by the major advisor. All students in the Ph.D. program are expected to complete at least 44 credits beyond the baccalaureate or its equivalent including at least 15 credits of GRAD 6950 Doctoral Dissertation Research. Students are expected to undertake an industrial internship for one or two summers. In addition, students must pass the qualifying examination in their first year, submit a plan of study in their second year, and pass a general examination in their third year. The final requirements for graduation are the completion of original research normally leading to the publication of several manuscripts and defense of a doctoral dissertation comprised largely from the manuscripts describing the original research.

Prerequisites/Requirements for Incoming Students

Students have succeeded in the Pharmaceutics Graduate program with backgrounds in Pharmacy, Chemistry, Chemical Engineering, Bioengineering, Polymer Science, Biology, Biochemistry and related fields. Students entering without four semesters of calculus and two semesters of physical chemistry are expected to complete these within their first year of graduate study. Other background courses may also be required by individual faculty members depending upon the nature of the student's prior education and future research direction. A qualifying examination will be administered to all incoming Pharmaceutics graduate students, regardless of previous educational or professional background. The passing grade on each of the qualifying examinations is 70%. Students who do not achieve passing grades on specific sections of the examination will be required to earn a "B" or better in the course covering that section for which their background was inadequate. Failure to pass any part of the examination or earn a "B" or better in the corresponding course(s) will ordinarily be grounds for dismissal from the program.

Fundamental Course Requirements

Course	Title	Credits
Prerequisites if not previously completed		
MATH 1131Q & MATH 1132Q	Calculus I and Calculus II	
MATH 2110Q	Multivariable Calculus	
MATH 2410Q	Elementary Differential Equations	
or three credit equivalent		
CHEM 3563	Physical Chemistry I	3

GRAD 5910	Responsible Conduct in Research	1
PHAR 5293	Seminar in Pharmaceutics ²	1
PHAR 5297	Special Topics in Pharmaceutics	1-6

¹ Students will not receive graduate credit for this course.

² Students should register for Seminar in the Spring of their 2nd and 4th years in the program.

Third year	Complete general examination, data review session with committee and present research seminar
Fourth year	Present research seminar and schedule additional committee meetings
Fifth year	Seminar and dissertation defense

Core Requirements

Choose at least four of five from:

Course	Title	Credits
PHAR 6234	Advanced Biopharmaceutics	3
PHAR 6285	Complex Equilibria	3
PHAR 6286	Transport Processes	3
PHAR 6288	Kinetics and Mechanisms of Drug Degradation and Stability	3
PHAR 6290	Colloid Chemistry and Interfacial Phenomena	3

Elective Requirements

PHAR 5297 Special Topics in Pharmaceutics and PHAR 6242 Freeze Drying of Pharmaceuticals. Students also take other electives outside of the discipline.

Industrial Internship

Students are expected to undertake an industrial internship for at least one summer, usually the summer between their first and second years in the program.

Seminars

While students are expected to attend the Pharmaceutics seminar each semester, students are only required to register for the seminar PHAR 5293 Seminar in Pharmaceutics in the Spring of their 2nd and 4th year in the program.

General Examination in Pharmaceutics

The general examination in Pharmaceutics will be comprised of evaluation of the written Dissertation Proposal and an oral defense thereof.

Academic standards

Wherever a student's cumulative average falls below a 3.0 or if they receive a grade of "C" more than once, the student's progress will be reviewed by the Pharmaceutics faculty to determine whether or not the student shall be permitted to continue graduate study.

Publications

Ordinarily, it is expected that each student will have one or more publications accepted and one or more publications submitted at the time of the Ph.D. dissertation defense. Accepted and submitted publications are often included as chapters in the graduate student's Ph.D. Dissertation.

Timeline Guidance for Graduate Students

Year	Guidance
First year	Complete qualifying examinations and/or prerequisites, submit Plan of Study
Second year	Present first seminar