

Masters of Science in Pharmaceutical Sciences

Curriculum:

Master of Science in Pharmaceutical Sciences (MSPS)

45 Credits Total

First Year - Fall Semester

PHAR 512	Immunology	3
PHAR 513	Biochemistry	3
PHAR 514	Pharmaceutics I	2
PHAR 611	Principles of Pharmacology	3
PHAR 612	Principles of Med. Chemistry	3
PHRSC 510	Seminar & Journal Club 1	1
PHRSC 527	Data Analysis and Biostatistics	3
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		Subtotal: 18

First Year - Spring Semester

PHAR 522	Pathophysiology	3
PHAR 523	Genetics & Genomics	2
PHAR 524	Pharmaceutics II	2
PHAR 525	Pharmaceutics II Lab	1
PHRSC 520	Seminar & Journal Club 2	1
PHRSC 526	Analytical Techniques	1
PHRSC ###	Pharm. Sci. Elective	3
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		Subtotal: 13

First Year - Summer Semester

PHRSC 528	Thesis Research 1	2
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		Subtotal: 2

Second Year - Fall Semester

PHRSC 610	Seminar & Journal Club 3	1
PHRSC 618	Thesis Research 2	2
PHRSC ###	Pharm. Sci. Elective (decided in consultation with Thesis Advisor)	3
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		Subtotal: 6

Second Year - Spring Semester

PHRSC 620	Seminar & Journal Club 4	1
PHRSC 628	Thesis Research 3	2
PHRSC ###	Pharm. Sci. Elective (decided in consultation with Thesis Advisor)	3
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		Subtotal: 6

Degree completion occurs when all courses are passed (C or better), with no more than two courses with a grade of "C" or "C+"; the cumulative degree GPA= \geq 3.0; and student has successfully defended their thesis.

General Information

Recent years have seen a rapid shift in the pharmaceutical world with innovations in biotechnology and major advances in fields such as genetics, immunology, neuroscience,

cancer, bioengineering and nanotechnology. The last year alone has significantly challenged our understanding of microbiology and infectious diseases. These developments have led to the generation of several new categories of drugs and other therapeutic targets leading to increased understanding of their pharmacology, medicinal chemistry, pharmaceutical analysis, and analytics. Our Masters in Science in Pharmaceutical Sciences (MSPS) program at Western New England University is designed to allow students to gain first-hand knowledge of these concepts by training with faculty in each of these areas of expertise. This program, built on a foundational knowledge of the above sciences with opportunities to perform specific research in these areas, will prepare master's students for a career in the biomedical and pharmaceutical sciences both in academic research and drug industry settings.

Program Goals and Objectives

The program is designed to allow students to successfully embark onto careers in academic research and industry settings. Students will have the opportunity to choose from a wide array of research focus areas in which to develop their Master's thesis and research. Faculty from the Department of Pharmaceutical and Administrative Sciences, as well as other faculty from throughout the University, are engaged in the provision of instruction and thesis advice, depending on the focus area. The curriculum designed for each focus area provides a solid foundation in the principles of the subject matter, as well as research experience in the applicable setting. The four focus areas are:

1. Pharmacological and Biomedical Sciences – These sciences encompass several disciplines with a primary focus on the biology of human health and disease. Research areas include molecular and cellular disease mechanisms, physiological and pathological processes of disease development, identification of new therapeutic targets, therapeutic and toxicological mechanisms of drug action, and novel approaches to therapeutics, including tissue engineering, genomics, and immunotherapy.
2. Pharmaceutics and Drug Delivery - These multidisciplinary sciences deal with the development and characterization of dosage forms, focusing on the development of new carrier systems for the effective delivery of drugs and the reduction of side effects. These sciences provide curricular content in the areas of formulation science, biomaterials, biopharmaceutics, pharmaceutical compounding, nanotechnology, and pharmacokinetics.
3. Medicinal Chemistry and Drug Development – These research areas deal with rational-based drug design and the identification of drug targets. In these interdisciplinary fields, one can learn about the synthesis of new drug molecules, the structure-activity relationship of drug classes, the uses of combinatorial chemistry, the methods of drug biotransformation, and the development of assays to test drug candidates.
4. Pharmacoeconomics and Healthcare Data Analytics
 - Pharmacoeconomics analyzes the costs and outcomes of pharmacy products and services to guide decision-making for payers, patients, and healthcare organizations, including cost-minimization, cost-effectiveness, cost-benefit, and cost-utility analyses.

- Healthcare data analytics is the science of exploring data in various healthcare industries to predict trends and treatment outcomes, modify health behaviors, support decision-making, optimize costs and improve various aspects of healthcare delivery.

In light of the above focus areas, students will be expected to fulfill the following primary goals and objectives prior to graduation, which will demonstrate competency in core knowledge areas and relevant skill sets:

1. To comprehend and have a thorough understanding of fundamental biological systems, processes and core principles that are critical to proficiency in the pharmaceutical sciences. This includes knowledge of basic cell biology, biochemistry, genetics, immunology and other biological systems which may be derived from core courses as well as reading of scientific literature.
2. To comprehend and have a thorough understanding of pharmaceutical sciences and focus areas critical to developing proficiency in this field, including pathophysiology, pharmacology, medicinal chemistry and drug development, pharmaceuticals and drug delivery, pharmacoconomics and health care delivery. This will be achieved through taking core courses in the program, study of the scientific literature, and participating in research in a specific focus area.
3. To gain an understanding and proficiency in basic pharmaceutical techniques. This will be achieved through taking the Analytical Techniques course and participating in thesis research.
4. To achieve proficiency in understanding and applying biologically relevant statistical analysis to research methodology and experimental data interpretation. This will be achieved through taking the Data Analysis and Biostatistics course, studying the scientific literature, participating in research and analysis of experimental data.
5. To be abreast of current scientific advances in the pharmaceutical sciences. This will be achieved through study of the scientific literature, attending journal clubs and seminars, and presentation of research articles and research data.
6. To develop proficiency in skills such as hypothesis testing in a focus area of the program. This will be achieved through developing a hypothesis that tests a specific research question in the pharmaceutical sciences and designing experiments to test that hypothesis under the supervision of a research or thesis mentor. This will be presented in a dissertation proposal comprising the hypothesis and designated experiments.
7. To develop proficiency in executing aims of a research project based on specifically developed hypotheses. This will be achieved through performing laboratory experiments

that fulfill the aims of the project under the supervision of a thesis advisor and a thesis committee.

8. To develop proficiency in the analysis of experimental data and its interpretation acquired in fulfillment of a hypothesis-driven research project. This will be achieved through analysis of research data acquired from performing experiments in a thesis advisor's laboratory and under the advisor's supervision.
9. To develop proficiency in presentation of research data acquired in fulfillment of a hypothesis-driven research project. This will be achieved through presentation of research data in seminar courses, in posters, at conferences, and in research articles under a thesis advisor's supervision.
10. To develop proficiency in synthesizing experimental data from a research project and utilizing it to draw conclusions about the original hypothesis. This will be achieved through:
a) submission of a thesis that summarizes the hypothesis, the experiments designed to test the hypothesis, the provision of data acquired from experimental analysis, data interpretation, and its discussion relevant to the hypothesis; and b) an oral defense of the thesis. Additional secondary means of demonstrating proficiency in this area will be presentation at research conferences and publication of research data.

Program Structure

All students will be assigned an advisor (the Program Coordinator) on entry into the program. The advisor will assist students during the first year of the program in developing a course load consistent with the goals of the program and taking into account the student's research interests. The advisor will also assist the student in selecting a thesis advisor. Students will be required to select a thesis advisor during the first year of the program. This selection will be done by reaching out to potential advisors and learning about their research interests, mutual interactions at journal club and seminar courses, or through interactive meetings set up by the Program Coordinator. In addition to faculty in the College of Pharmacy and Health Sciences, faculty across the university will participate in our program as thesis advisors. These include faculty from biology, chemistry, neuroscience, bioengineering, and other areas. These faculty will bring their own individual expertise to this program. In coordination with the thesis advisor, students will also select members of the thesis committee, two of which must be from the College of Pharmacy and Health Sciences, during the first year of the program. Pursuant to this, students will present a dissertation proposal, approved by the thesis committee, in order to proceed in the program. During the summer semester of the first year and the second academic year, students will fulfill the experiments described in the dissertation proposal in the thesis advisor's laboratory. On completion of the research, a thesis summarizing the student's hypothesis, research data, and its interpretation must be submitted and defended orally to faculty and students. Approval of the thesis and its defense by the thesis committee will constitute graduation in the program. It is expected that students will participate in

presentation of research data (posters, oral presentations, and publications) whenever appropriate.

The College of Pharmacy and Health Sciences is located in the \$40 million Center for the Sciences and Pharmacy (CSP), which was built in 2011. As a fully inclusive facility, the CSP houses classes, laboratories, and faculty offices, unifying resources in a single location. Auditoriums and seminar rooms in the CSP are equipped with the latest educational technology to optimize the delivery of information. In addition to teaching technology, students will have access to laboratories equipped with instrumentation and resources such as a real time PCR machine, flow cytometer, spectrophotometer, tissue culture, mass spectrometers, nuclear magnetic resonance, etc.