

# Pharmaceutical Sciences/ Medicinal Chemistry (M.S.)

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## About The Program:

The School of Pharmacy offers a graduate program leading to the M.S. and to the Ph.D. in Pharmaceutical Sciences with a concentration in Medicinal Chemistry. The program is designed to prepare students for positions in the pharmaceutical industry, government agencies, and faculty positions in schools of pharmacy.

**Career Options:** The program is primarily concentrated to provide research scientists for the pharmaceutical industry, government agencies, and faculty positions in schools of pharmacy.

**Prerequisites for Admission:** A baccalaureate degree in Biochemistry, Chemistry (preferably Organic Chemistry), or Pharmacy is required.

**Areas of Specialization:** The focus is Medicinal and Pharmaceutical Chemistry, including design and synthesis of ligands for nicotinic receptors and ligands for retinoic acid receptors, novel anticonvulsants, and the development of analytical methodologies.

## Requirements of Programs:

- **Total Credit Hours:** 30
- **Culminating Events:**

### *Thesis:*

The M.S. thesis is an original, theoretical, and/or empirical study that contributes to the field of Medicinal/Pharmaceutical Chemistry. It should expand existing knowledge and demonstrate the student's knowledge of research methods and a mastery of her/his primary area of interest. The thesis should be rigorously investigated; uphold the ethics and standards of the pharmaceutical sciences; demonstrate an understanding of the relationship between the primary area of interest and the broader field of medicinal chemistry; and be prepared for publication in a professional journal.

Students who are preparing to defend their thesis should confirm a time and date with their advisor and register with the Administrative Assistant at least 15 days before the defense is to be scheduled. The Administrative Assistant arranges the time, date, and room within two working days and forwards to the student the appropriate forms. Once approved, the public announcement of the defense is posted.

The Thesis Examining Committee evaluates the student's ability to express verbally her/his research question, methodological approach, primary findings, and implications. This committee is comprised of at least three Graduate Faculty members. Two members, including the Chair, must be members of the Graduate Faculty of the School of Pharmacy. The Thesis Examining Committee votes to pass or fail the thesis and the defense at the conclusion of the public presentation.

## Core Courses

**Pharmaceutical Analysis** - Application of chemical analysis as it relates to pharmaceuticals and pharmaceutical manufacturing. Classical separation methods including GC, HPLC, and NMR as well as hyphenated techniques (GC-MS & HPLC-MC) will be explored. The student will also be introduced to immunologic antibody based procedures and emerging technologies.

## Seminar in Pharm Science

**Department of Pharmaceutical Sciences Seminar Series** - The goal of the course is to expose graduate students in the Department of Pharmaceutical Sciences to the faculty research in our department. Students will be presented with a number of research topics, including pharmaceuticals, pharmacokinetics, medicinal chemistry, biotransformation, pharmacology, and physiology. In addition to the presentations by faculty members, several guest speakers will present their research topics and discuss their opinions on science careers outside of academia (i.e., industry, medical writing, medical science liaison, etc.). Through exposure to these diverse research topics, students will become more well-rounded scientists and become more aware of career opportunities that are available to them.

**Pharmacokinetics** - The objective of this course is to present the fundamental principles of pharmacokinetics (PK). The topics will include PK data analysis, dosage regimen design, and the determinants of drug absorption, distribution, metabolism, and excretion. Pharmacodynamics, the study of drug concentration - response relationships, will also be presented.

**Principles in Drug Discovery** - In this course, students will receive an introduction to the fundamental principles of drug discovery and development, beginning with an historical overview of drug discovery.

## Bioethics in Research

**Advanced Pharmacogenomics** - The course is a one semester course focused on inherited factors that modulate drug response. Special problems of genetic variability in humans, detection and prediction of pharmacologically relevant genetic polymorphisms will be discussed. The course will integrate current mechanistic knowledge of drugs, human genetics, data mining, and analytical tools to tailor drug administration for a specific genetic background.

**Medicinal Chemistry I** - The course provides students with information regarding the chemical and physical properties of biomolecules. Moreover, the interrelated roles of these molecules in a functioning biological system are emphasized. As we progress through the course, study with the following goals in mind: Learn to speak the language of medicinal chemistry and comprehend the meaning, significance, and origin of terms; Understand the physical, chemical and biological context in which each biomolecule, reaction, or pathway operates; Focus on major themes, especially those relating to regulation, thermodynamics, and the relationship between structure and function; Know the most important techniques that have brought us to our current understanding of biochemistry/medicinal chemistry; Make connections between pathways and identify gaps in our knowledge that promise to challenge future generations of scientists. Upon course completion you should be able to: Understand the fundamental relationships between biochemistry, medicinal chemistry and pharmacology; Describe the metabolic pathways responsible for normal and abnormal human physiology; Identify the biochemical impact of diseases and some of the drugs used to treat these conditions.

**Statistical Quality Control** - An introduction to statistical concepts, this course reviews control charts for variables, probability theory, control charts for attributes, and acceptance sampling systems. Class discussions include application to quality control of pharmaceutical manufacturing.

### Concentration-Specific Courses

**Advanced Medicinal Chemistry I** - Discussions of the organic chemistry of drug action and drug design. Current topics in the field are discussed using examples from the recent literature. The design, synthesis and structure activity relationships for major therapeutic drug classes are discussed in detail.

**Advanced Medicinal Chemistry II** – Continued discussions of the organic chemistry of drug action and drug design with current topics discussed using examples from the recent literature. Students review the current literature, give presentations and write research proposals based on their readings and class materials.

### Electives (2 credits)

#### Non-Didactic Course

**Master's Research** - Master's Research course appropriate for students finished with coursework and working with a faculty member on the thesis.

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### Courses:

Click [HERE](#) for more information on the courses below.

- Statistical Quality Control
- Biotechnology: Bioprocess Basic
- Good Manufacturing Practices
- High Purity Water System
- Production of Sterile Products
- Sterilization Processes
- Pharmaceutical Drug Dosage Forms
- Development of Sterile Products
- Regulatory Sciences
- Topics in Pharmaceutical Sciences
- Principles of Drug Action/  
Pharmacokinetics
- Pharmaceutical Analysis
- Pharmaceutical Manufacturing I:  
Preformulation/ Formulation
- Pharmaceutical Manufacturing II
- Pharmaceutical Biotechnology
- Physical Pharmacy I
- Applied Biopharmaceutics
- Advanced Principles of Pharmacokinetics
- Advanced Medicinal Chemistry I
- Advanced Medicinal Chemistry II
- Radioisotope Methodology
- Seminar in Pharm Science
- Introduction to Toxicology
- Department of Pharmaceutical Sciences  
Seminar Series
- Writing and Publishing a Review Article
- Bioinformatic Genes Drug
- Journ Club/ Pharmacodynam
- Laboratory Experience in Pharmaceutical  
Sciences
- Pharmacokinetics
- Principles in Drug Discovery
- Bioethics in Research
- Principles of Biochemistry
- Topics in Pharmaceutical Biotechnology
- Introduction to Translational Molecular  
Technology
- Neuroscience of Pain
- Pharmacodynamics
- Advanced Pharmacogenomics
- Pharmaceutical Sciences Literature  
Review

- Abuses of Drugs and Chemicals
- Modified Release Dosage Forms
- Advanced Pharmacokinetic Modeling I
- Physical Pharmacy II
- Chemical Surfaces & Interfaces
- Advanced Drug and Gene Delivery Systems
- Food and Drug Law
- Dermatopharmaceutics
- Teaching in Higher Educ
- Preliminary Examination Preparation
- Master's Research