

## PHARMACEUTICAL SCIENCES (MPS)

Program Director: Manzoor M. Khan  
Program Office: Hixson-Lied Science Building, Room 167

### GRADUATE STUDY IN PHARMACEUTICAL SCIENCES

The graduate program in Pharmaceutical Sciences encompasses a multi-disciplinary approach to graduate training, culminating in the M.S. degree. The program is administered by the Department of Pharmacy Sciences, School of Pharmacy and Health Professions and the Department of Pharmacology, School of Medicine.

The program of study leads either to a joint (dual track) Doctor of Pharmacy (Pharm.D.)/M.S. or to an M.S. degree only. Two types of students are envisioned as entrants in this program. The first type consists of students who possess a B.S. degree in pharmacy or a biological, physical or chemical science and wish to further their education in an advanced degree program. The second type consists of students who are currently enrolled in Creighton's Pharm.D. program who want to obtain an additional advanced academic degree during the course of their studies. The program of study is tailored to the individual needs of each student and is based on the background and career objectives of each student. Students are expected to complete a series of required and elective courses and to perform original research. Furthermore, students are required to submit a thesis based on the outcome of their research. The program provides opportunity for students to specialize in the following areas: pharmacology, toxicology, pharmaceuticals, pharmacokinetics and medicinal chemistry. In addition, the program encourages student interactions with faculty in the Departments of Biomedical Sciences, Medical Microbiology and Immunology & Chemistry.

#### Program Goals

At the time of the completion of the program the graduates will be able to meet the following objectives:

1. Demonstrate competence in advanced knowledge in pharmaceutical sciences.
2. Illustrate the ability to analyze and interpret data, design and conduct research in their field of expertise.
3. Effectively communicate scientific information both orally and in writing to scientists and non scientists.
4. Apply analytical and critical thinking in reviewing literature.
5. Exhibit professionalism and the highest ethical standards.

#### Faculty

Professors: P. Abel, J. Bertoni, A. Dash, F. Dowd, T. Murray, V. Roche;  
Associate Professors: N. Alsharif, K. Keefner, A. Kincaid, A. Limpach, C. Opere, V. Padron,  
D. Petzel, R. Reidelberger, M. Scofield, M. Shara, S. Singh, D. Smith, Y. Tu.  
Assistant Professors: C. Bockman, B. Henrickson, J. Tollman.

#### Admission Requirements

1. A Bachelor's degree or its equivalent from an accredited college or university.
2. Students who are in the Pharm.D. program must be admitted into the Graduate School in order to participate in the joint Pharm.D./M.S. program in pharmaceutical sciences.
3. An overall GPA of 3.0 and a combined GRE score above 1500 is desired.
4. The Graduate School requires all students from countries in which English is not the native language to demonstrate competence in English by a score of 550 in the TOEFL (Test of English as a Foreign Language) examination or 80 on the Internet-based Test (iBT) at the graduate level.

#### Master of Science (M.S.) and Doctor of Pharmacy/Master of Science (Pharm.D./M.S.)

The general requirements of the Graduate School Bulletin listed under Administration and Policies Governing Graduate Study are met. Courses can be selected from the list below or from related subjects, according to the needs of the student. To qualify for the degree, the student must earn at least 30 semester hours of graduate credit beyond the baccalaureate. The student must maintain a B (3.0) average grade throughout the graduate program.

## Special Requirements

The following requirements are applicable to students enrolled in the Pharm.D./M.S. program:

1. A maximum of four credit hours of seminar and a maximum of six credit hours of thesis can be applied toward the M.S. degree.
2. Not more than 12 credit hours of Pharm.D. courses can be applied toward the M.S. degree.
3. A minimum of 12 credit hours must be earned in courses that are not listed as required courses for the Pharm.D. degree.
4. A minimum of 30 credit hours is required for graduation.
5. A typical plan of study consists of the following:

Dual Credit (Pharm.D.) Courses	12 credits
Graduate Credit Only Courses	12-15 credits
Seminar	3-4 credits
Thesis	<u>6 credits</u>
	33-37 credits

## Master of Science (M.S.) with Major in Pharmaceutical Sciences (33-37 credits)

### Coursework

#### Pharm.D./M.S. Dual Listed Courses

MPS 521/BMS 521	Biochemistry	4 credits
MPS 531/PHA 337	Chemical Basis of Drug Action I	3 credits
MPS 532/PHA 447	Chemical Basis of Drug Action II	3 credits
MPS 544/PHA 444	Biostatistics and Research Design	3 credits
MPS 509/PHA 467	Industrial Pharmacy	2 credits
MPS 631/PHR 631	Medical Pharmacology I	5 credits
MPS 632/PHR 632	Medical Pharmacology I	5 credits
MPS 690/PHA 459	Pharmacology of Immune Response	2 credits

### Graduate Courses in Other Departments

With permission from their supervisor, students in the program may also enroll in graduate courses offered by other departments. Listed below are examples of courses offered by other departments that may be relevant to the M.S. degree program.

#### Biomedical Sciences:

BMS 603	Cell Biology	4 credits
BMS 604	Molecular Biology	4 credits
BMS 605	Molecular Endocrinology	3 credits
BMS 607	Enzymes	4 credits
BMS 608	Peptide Chemistry	4 credits
BMS 606	Proteins	4 credits
BMS 609	Biochemistry of Lipids	4 credits
BMS 610	The Carbohydrates	3 credits

#### Medical Microbiology:

MIC 615	Medical Microbiology and Immunology	5 credits
MIC 739	Microbial Physiology	4 credits
MIC 753	Antimicrobial Agents and Chemotherapy	4 credits
MIC 727	Methods in Medical Microbiology and Immunology	3 credits
MIC 746	Advanced Immunology	3 credits

#### Ethics

IDC 601	Responsible Conduct of Research	3 credits
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**MPS 531 Chemical Basis of Drug Action I (3)**  
This course instructs the student on the chemical basis for drug behavior, both in vivo and in vitro. General chemical principles, physicochemical properties, and drug-receptor interactions are used to derive structure-activity relationships for important and commonly encountered classes of drugs. This permits the understanding of pharmacological and biopharmaceutical profiles of currently available drug products, and explains the scientific rationale behind their therapeutic use. Chemically based therapeutic case studies and structurally based therapeutic evaluations are utilized to help students develop a scientific basis for rational therapeutic decision-making. This practice-oriented approach, which emphasizes the relevance of chemistry to contemporary pharmacy practice, gives students the skills necessary to predict biological properties and therapeutic activities of future drug molecules. This course builds upon previously acquired knowledge of biochemistry, pharmaceuticals and basic pharmaceutical sciences principles, and compliments concepts being addressed in pharmacology. **P: BMS 302.**

**MPS 532 Chemical Basis of Drug Action II (2)**  
A continuation of PHA 337.

**MPS 544 Biostatistics and Research Design (3)**  
This course is an introduction to statistics and research design. The course covers basic statistical concepts, techniques, notations and computations including descriptive and inferential statistics with an emphasis on statistical methods, computerized data analysis and data assessments most commonly associated with pharmaceutical and medical research. Basic descriptive and inferential statistical processes and procedures are presented as well as topics on the development of research protocols, survey research, clinical drug investigations, and grant development. **P: PHA 318.**

### *Graduate Courses in Pharmaceutical Sciences*

**MPS 600 Ocular Pharmacology (2)**  
Utilization of knowledge of physiology, biochemistry and anatomy of the eye to develop an understanding of etiology and pharmacological therapy of various ocular diseases. Course content will include a review of anatomy, physiology and biochemistry of the eye, pharmacokinetics and drug delivery relevant to ocular therapy, etiology and pharmacological treatment of ocular diseases such as glaucoma, uveitis, cataract, retinopathy and age-related macular degeneration and cataract. Ocular effects of systemic drugs and ophthalmic toxicology will be examined, in addition to examining advances in ocular therapies.

**MPS 601 Parental Drug Dosages Forms (3)**  
Parental Drug Products incorporates basic theory and practical experience in the preparation, handling, and dispensing of sterile dosage forms including proper aseptic preparation of parenteral chemotherapeutic agents, and specialty solutions. U.S.P. Chapter 979 will be thoroughly reviewed and discussed. Parental access devices, electronic delivery devices and other related equipment are also reviewed.

**MPS 602 Analytic Aspects of Pharmaceutical Sciences Research (3)**  
This course covers the theory, instrumentation and application of commonly used laboratory equipments, including, absorption spectroscopy (UV, visible and infrared); mass spectroscopy (MS), high pressure liquid chromatography (HPLC) and nuclear magnetic resonance (NMR), amongst others. The course will combine lectures with hands-on laboratory exercises/demonstrations by Pharmacy Sciences faculty.

**MPS 617 Advanced Pharmaceutics (3)**  
This course will provide an in-depth study of the physical and chemical principles which are involved in the development, formation and stabilization of selected pharmaceutical dosage forms for optimization of drug bioavailability and therapeutic utility.

**MPS 622 Advanced Medicinal Chemistry (3)**  
This course will build upon the scientific foundation laid by the Chemical Basis of Drug Action professional course sequence. The structure-activity relationships of complex drug molecules will be investigated and discussed. Students as well as faculty will be involved in presenting information on the chemically important aspects of drug delivery, stability, receptor affinity and selectivity, metabolic vulnerability and distribution.

- MPS 633 Research Methods (1-3)**  
 Laboratory rotations in which graduate students perform or observe methods used in pharmaceutical and administrative sciences research. The value of the methods and their applications to the research efforts of the pharmaceutical sciences faculty are described in detail. **P: DC.**
- MPS 665 Advanced Pharmacokinetics (2)**  
 Computer modelling of the absorption, distribution, metabolism, and excretion of drugs will be the core of the course content. Multicompartmental analysis, non-compartmental analysis as well as non-linear kinetics will be discussed. Development of a pharmacokinetic protocol through the various phases of INDA submission as well as in vitro - in vivo correlations will be considered.
- MPS 675 Solid Delivery Systems (3)**  
 The course uses a physical chemistry approach to solving the problems associated with practical design of solid dosage forms as well as those associated with their evaluation.
- MPS 676 Disperse Systems (3)**  
 The course uses a physical chemistry approach to solving the problems associated with practical design of disperse system dosage forms as well as those associated with their evaluation.
- MPS 677 Macromolecular Systems (3)**  
 The course uses a physical chemistry approach to solving the problems associated with the manufacture, evaluation and utilization of polymers in the design of drug delivery systems as well as macromolecules as drugs.
- MPS 690 Pharmacology of Immune Response (2)**  
 The course will provide instruction about the pharmacologic regulation of immune response and the role of immune products on human physiology. **P: Gr stdg.**
- MPS 691 Pharmaceutical Sciences Seminar (1-3)**  
 Seminar in selected subjects for pharmaceutical sciences graduate students. **P: DC.**
- MPS 692 Directed Independent Study (1-5)**  
 Supervised independent projects that may include laboratory work, assigned readings, research papers, etc. Available in toxicology, biopharmaceutics, medicinal chemistry, pharmacodynamics and pharmacokinetics. **P: Undergraduate or graduate stdg. & DC.**
- MPS 693 Directed Independent Research (1-8)**  
 Supervised independent research for motivated students to become involved in ongoing original research projects of the pharmaceutical sciences faculty. **P: Undergraduate or graduate stdg. & DC.**
- MPS 697 Industrial Pharmacy (3)**  
 This course will prepare students to design, manufacture and evaluate different pharmaceutical dosage forms in an industrial environment. The course content will include preformulation studies, formulation of liquid and solid oral pharmaceutical dosage forms, recent advances and trends in controlled or sustained release formulations, drug regulatory affairs and current good manufacturing practices. **P: PHA 315.**
- MPS 792 Journal Club (1)**  
 Graduate students in Pharmaceutical Sciences will learn how to read journal articles for optimum retention, critically evaluate the data, and objectively determine the paper's contribution to the over-all body of knowledge. In addition they will gain valuable presentation and public speaking skills. **P: DC.**
- MPS 797 Master's Directed Independent Research (1-8)**  
 Supervised original research. **P: DC.**
- MPS 799 Master's Thesis (1-8)**  
 Review of the literature and research data; writing of the thesis. Student must register for this course in any term when engaged in formal preparation of the Master's thesis; however, six credit hours are the maximum applicable toward the degree. **P: DC.**