Graduate Program in Pharmaceutical Science

The following is a listing of courses offered by the Graduate Program in Pharmaceutical Science. Prerequisites and brief descriptions are included for each course. For more information on a particular course, please consult the Graduate Course Catalog, the Program Director, or the course instructor(s).

Graduate Courses:

Advanced Pharmaceutics

Prerequisites: Physical chemistry and associated math requirements
Course No: 16:720:507
Instructor: Sinko
Credits: 3
Description: The application of physical-chemical principles to the study and evaluation of pharmaceutical systems: solubility phenomena, equilibria, complexation.

Advanced Pharmacokinetics & Dynamics

Prerequisites: Ordinary differential equations (or equivalent)
Course No: 16:720:509
Instructor: Kong
Credits: 3
Description: This course will cover the current development of the methods, models, and equations used in pharmacokinetics along with their physicochemical and physiological assumptions and limitations. Graphical, computer methods of data analysis, and applications of pharmacokinetic (PK)-pharmacodynamic (PD) modeling of time-course of pharmacologic responses in biological systems will be surveyed and discussed.

Molecular and Cellular Pharmaceutics

Course No: 16:720:614
Instructor: Minko
Credits: 3
Description: The specific aim of this course is to familiarize the students with modern conception of cellular response to drugs in different dosage forms and drug delivery systems. The course will provide insight into the transport through biological barriers of different drug delivery forms, the main cellular signaling pathways triggered by various drugs and drug formulations, types of cell death induced by various types of modern drugs, cellular adaptation to the drug exposure, cellular mechanisms of multidrug resistance, interaction between drugs and DNA. It also will enable the student to have a basic understanding of the principles of pharmacogenomics and pharmacogenetics.

MembraneTransporters in Drug Disposition

Course No: 16:720:609
Instructor: You
Credits: 3
Description: Transporters are membrane proteins that span cellular membranes and are the gatekeepers for all cells and organelles, controlling intake and efflux of crucial endogenous substrates such as sugars, amino acids, nucleotides, and inorganic ions. The specificity of many transporters however is not limited to their physiological substrates, and for some, their physiological substrates remain undiscovered. Xenobiotics (drugs, dietary and environmental compounds) have the potential to be recognized by transporters. These transporters crucially influence the absorption, distribution, and elimination of drugs in the body. This course will provide an overview of the relevant drug transporters, their roles in human physiology and diseases and will present the principles of drug transport and its associated techniques.

phase transitions, and pharmaceutical stability, and the fundamentals of pharmacokinetics.

Useful Links

- **Curriculum**
- **University Schedule of Classes**
- **Seminar Schedule**
- **Pharmaceutical Science Program Home Page**
- **Department of Pharmaceutics Home Page**
- **Department of Chemical Biology Home Page**

Dermaceutics
Prerequisite:
Course No: 16:720:523
Instructor: Michniak
Credits: 3
Description: Design of topical drug delivery systems; theoretical and practical considerations in development of topical disperse systems; skin permeation of drugs and its optimization; dermatologic and cosmetic applications.

Genetically Engineered Drug Delivery Systems
Pre-requisite: Molecular and Cell Biology
Course No: 16:720:549
Credits: 3
Description: This course is designed to introduce variety of concepts related to genetically engineered therapeutic systems with emphasis on biopolymers (recombinant polymers), viruses and stem cells.

Molecular Toxicology
Course No: 16:963:505
Credits: 4
Instructor: Zhou
Description: Laboratory techniques used in toxicological research. Students will analyze research data and evaluate the techniques used.

Fundamentals of Molecular Biosciences
Course No: 16:695:538
Credits: 6
Instructor:
Description:

Molecular Biology and Biochemistry
Course No: 16:115:511,512, or 01:694:407
Credits: 3,3
Instructor:
Description: First term: structure and function of proteins, nucleic acid structure, catalysis of biochemical reactions, glycolysis, oxidative phosphorylation. Recombinant DNA approaches, DNA replication, mutability, recombination, repair, and transposition. Second term: transcription, posttranscriptional processing, translation, gene regulation, photosynthesis, properties of membranes, signal transduction, intermediary metabolism. ***Prerequisite: One year organic chemistry. These courses recommended for students outside the program in biochemistry.***

Pharmacogenomics and Precision Medicine
Course No: 30:158:409
Credits: 2
Instructor
Description:

Ethical Scientific Conduct
Course No: 16:115:556
Credits: 1
Description: Introduction to ethical issues of scientific investigation, including intellectual property, plagiarism, conflict of interest, human and animal subjects, and record keeping.

Independent Research Proposal
Enrollment limited to Ph.D. candidates with approval of their adviser.
Course No: 16:720:540
Credits: 3
Description: Develop a written research proposal using the standard HHS/NIH format as part of the Ph.D. degree requirements. Proposal is evaluated as to its originality, scientific merit, and quality.

Seminar in Pharmaceutical Science
Course No: 16:720:601,602
Credits: 1 per semester as required
Description: Presentation and discussion of recent developments in the pharmaceutical sciences.

Research in Pharmaceutical Science
Course No: 16:720:701,702
Credits: By arrangement
Description: Research undertaken with the student's advisor as part of the thesis or dissertation.

Additional Graduate Courses

Basic Statistics for Research
Course No: 01:960:401
Credits: 3
Description:

Design of Experiments
Course No: 16:960:590
Credits: 3
Description: Fundamental principles of experimental design; completely randomized variance component designs; randomized blocks; Latin squares; incomplete blocks; partially hierarchic mixed-model experiments; factorial experiments; fractional factorials; and response surface exploration. ***Prerequisite: 01:960:484 or 401 or equivalent.***

Introduction to Biopharmaceutics and Pharmacolinetics
Course No: 30:721:430
Credits: 4
Description: This course will introduce students to the basic concepts and principles in biopharmaceutics and pharmacokinetics. Biopharmaceutics describes the role of dosage form in the absorption and disposition of drugs in the body. Pharmacokinetics describes the processes involved in the Absorption of a drug (in part determined by biopharmaceutics) from its site of administration into the blood circulation, Distribution of the drug to its sites of action, Metabolism of the drug, and its subsequent Excretion of the drug from the body (ADME). Processes that influence the pharmacokinetics of drugs, including formulation, physico-chemical, physiological, pharmacological and pathological factors will be discussed. The use of mathematical equations to describe the pharmacokinetic concepts and principles of drug action are introduced and applied to dosage regimen determinations.

Independent Study in Pharmaceutical Science
Course No: 16:720:610,611
Credits: 1-3
Description: Independent library and/or laboratory research into special aspects of pharmaceutical science; arranged under the supervision of a specific faculty member. No more than 3 credits may be taken as part of a student's program.

General Toxicology I, II
Course No: 16:963:501,502
Credits: 2, 2
Instructor: Gallo, Richardson
Description: Basic principles of toxicology, organ toxicology, toxicology of specific chemical agents and radiation; overview of environmental and industrial toxicology and safety evaluation. ***Prerequisites: 16:115:503,504, 16:761:501,502, or equivalent.***

Medicinal Chemistry: Research Techniques and Principles
Course No: 16:663:501
Credits: 3
Instructor: Rice
Description: Basic course for students preparing to do research in medicinal chemistry. Information management,

computer methods, basic laboratory techniques and principles of medicinal chemistry. ***Prerequisites: 01:160:305,306, or equivalent.***

Principles of Drug Design
Course No: 16:663:502
Credits: 3
Instructor: Hu, Kerrigan
Description: Identifying new drug leads, drug absorption and distribution, pharmacomodulation, enzymes and receptors as targets, peptidomimetics, computer-aided drug design, and combinatorial chemistry; ***Prerequisites: 16:160:305,306, or equivalent.***

Strategies and Tactics in Synthetic Medicinal Chemistry
Course No: 16:663:504
Credits: 3
Instructor: Rice
Description: Design of syntheses for complex organic medicinal agents. Preparation of series of analogs for structure-activity investigations. ***Prerequisite: 16:160:503 or equivalent.***

Drugs: Structure and Function
Course No: 16:663:505
Credits: 3
Instructor: LaVoie
Description: A survey of the major pharmaceutical agents in clinical use. Emphasis on the influence of chemical structure in the elicitation of pharmacological effects. ***Prerequisites: 01:160:305,306, or equivalent.***

Introduction to Molecular Modeling
Course No: 16:160:510
Credits: 3
Instructor:
Description: Introduction to the use of computer-assisted molecular modeling techniques for the study of chemical problems; lectures on theoretical principles; instruction in use of modern modeling programs; computer projects involving solution of chemical problems. ***Prerequisites: 01:160:307,308, 323,324; or equivalent.***

Pharmaceutical Process Design II (Unit Operations)
Course No: 16:155:546
Credits: 3
Instructor:
Description: An introduction to the essential operations used in the manufacture of pharmaceutical products. The pharmaceutical product life cycle, variability, testing, and specifications of pharmaceutical ingredients. Unit operations including blending, granulation, fluidized bed operations, milling, capsule filling, compaction, tablet coating, and other processes will be addressed. How the output of one process is the input to the next process, and how deviations can cascade along the production sequence until they cause process failures. Design, scale-up, troubleshooting, and optimization. Prerequisite: Permission of instructor.

Pharmaceutical Organic Nanotechnology
Course No: 16:155:544
Credits: 3
Instructor:
Description: An introduction to organic nanotechnology and its application to manufacturing drug products. Industrial pharmaceutical examples, including nanoparticle and nanocomposite synthesis. Prerequisite: Permission of instructor.

Advanced Engineering Pharmaceutical Kinetics, Thermodynamics, and Transport Processes
Course No: 16:155:549
Credits: 3
Instructor:
Description: Thermodynamics of pharmaceutical systems, phase diagram, phase equilibrium, and chemical equilibrium; diffusive and convective transport in pharmaceutical processes; chemical and pharmacokinetics and reaction engineering of pharmaceutical systems. Prerequisite: Undergraduate degree in chemical engineering or permission of instructor.

Regression Analysis
Course No: 16:960:563
Credits: 3
Instructor:
Description: Review of basic statistical theory and matrix algebra; general regression models; computer application to regression techniques; residual analysis; selection of regression models; response surface methodology; experimental design models; and analysis of covariance. Emphasis on applications. Prerequisite: Level IV statistics.

Introduction to Colloid and Interface Science
Course No: 16:400:612
Credits: 3
Instructor:
Description: Analysis and design of various colloidal systems in the context of fundamental physico-chemical interactions between surfaces/phases. Colloidal structures and their stability. Practical use of natural and engineered colloids for food; agricultural and pharmaceutical applications. Prerequisite: Calculus I.

Nanotechnology and Its Applications in Biotechnology and Food
Course No: 16:400:613
Credits: 3
Instructor:
Description: Basic concepts, investigation tools, and fundamental issues of nanotechnology, with emphasis on the applications of nanotechnology in agricultural and food systems, health care, food safety, and food packaging. Self-assembly, scanning probe microscopy, micro- and nanoencapulation, organic/inorganic nanocomposites, DNA, and protein chips. Prerequisites: Physical chemistry or permission of instructor.

Cellular and Molecular Pharmacology: Principles of Drug Action and Targeting
Course No: 16:718:680
Credits: 3
Instructor:
Description: Molecular basis of pharmacologic selectivity, drug targets, adaptive responses to drugs, disposition of drugs, and genetic and molecular approaches to drug therapy. Prerequisites: Permission of graduate director and instructor.