Pharmaceutical Sciences (PS)

Course information contained within the Bulletin is accurate at the time of publication in June 2025 but is subject to change. For the most up-to-date course information, please refer to the Course Catalog.

PS 3011. Introduction to Pharmaceutical Sciences I. 1 Credit Hour.
This is the first in a series of two courses that reviews the science and opportunities for students in the field of pharmaceutical sciences. The two courses will cover foundational concepts in drug discovery, development, and delivery, including basic biology, chemistry, microbiology, pharmacology, pharmacokinetics, pharmacodynamics, dosage forms, and quality control. In this semester, we will focus on understanding the scientific principles behind the initial design of drugs, considerations for the pharmacokinetics and metabolism of drugs, and the earlier processes of bringing a new medication to market. Finally, we will introduce our students to a breadth of disciplines and careers in pharmaceutical sciences as we introduce the basic principles of drug discovery.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in (MATH 1031, MATH 1041, or MATH 1941), (CHEM 2202 or CHEM 2922), (CHEM 2204 or CHEM 2924), (BIOL 1111 or BIOL 1911), (BIOL 1112, BIOL 1912, BIOL 2112, or BIOL 2912), (PHYS 1021, PHYS 1061, PHYS 1961, PHYS 2021, or PHYS 2921), (KINS 1222 or KINS 1224), and SCTC 2396.

PS 3012. Introduction to Pharmaceutical Sciences II. 1 Credit Hour.
This is the second in a series of two courses that reviews the science and opportunities for students in the field of pharmaceutical sciences. The two courses will cover foundational concepts in drug discovery, development, and delivery, including basic biology, chemistry, microbiology, pharmacology, pharmacokinetics, pharmacodynamics, dosage forms, and quality control. In this semester, we will focus on understanding the scientific principles behind the delivery of drugs, formulation development, preclinical and clinical testing and the later processes of bringing a new medication to market. Finally, we will introduce our students to a breadth of disciplines and careers in pharmaceutical sciences as we introduce the basic principles of drug discovery.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in PS 3011.

PS 3145. Immunology/Biotechnology. 3 Credit Hours.
This course provides foundational knowledge of the functions of the immune system at the molecular, cellular, and anatomical levels. The first part of the course describes the innate and adaptive immune systems, their cells and anatomical structures, their intricate methods of cell-cell communication, and how immune responses can be mounted against a virtually unlimited array of pathogens while minimizing collateral damage to the host. Next, we will consider natural immunity and vaccination against specific pathogens, immune responses in cancer and transplantation, and the unwanted consequences of immune responses in inflammation, hypersensitivity, and autoimmune diseases, and the drugs and vaccines to treat those conditions. The last part of the course will introduce the biotechnologies that are fueling the rapid discovery and development of vaccines and immunotherapeutic agents for a wide variety of diseases.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in (MATH 1031, MATH 1041, or MATH 1941), (CHEM 2202 or CHEM 2922), (CHEM 2204 or CHEM 2924), (BIOL 1111 or BIOL 1911), (BIOL 1112, BIOL 1912, BIOL 2112, or BIOL 2912), (PHYS 1021, PHYS 1061, PHYS 1961, PHYS 2021, or PHYS 2921), (KINS 1222 or KINS 1224), and SCTC 2396.

PS 3151. Medicinal Chemistry I. 4 Credit Hours.
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.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in (MATH 1031, MATH 1041, or MATH 1941), (CHEM 2202 or CHEM 2922), (CHEM 2204 or CHEM 2924), (BIOL 1111 or BIOL 1911), (BIOL 1112, BIOL 1912, BIOL 2112, or BIOL 2912), (PHYS 1021, PHYS 1061, PHYS 1961, PHYS 2021, or PHYS 2921), (KINS 1222 or KINS 1224), and SCTC 2396.

PS 3152. Medicinal Chemistry II. 4 Credit Hours.
The course is designed to provide an understanding of the importance of molecular structure and molecular properties in determining the pharmacodynamic (PD) and pharmacokinetic (PK) profiles of drug molecules. The goal of this segment of the course is to present the student with the basic principles of medicinal chemistry related to major drug classes that will enhance their ability to apply this basic, foundational knowledge to the practice of pharmacy. Basic principles/concepts/themes in medicinal chemistry will be introduced early in the course and then applied to various drug classes throughout the semester. The mechanisms of action of drug classes, common adverse effects of drug classes, and the structural features of drug molecules that are responsible for their activity (structure-activity relationships; SARs) will be major topics covered throughout the semester. The expected outcomes are that students will learn a body of knowledge that builds and integrates with other courses in the curriculum and can be applied to their practice of pharmacy. The foundational knowledge supplied in the course may be applied in practice now and in the future as new drugs, with new mechanisms of action continue to be approved.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in PS 3151.

PS 3161. Pharmaceutics I. 3 Credit Hours.
Upon the conclusion of this course students will have been introduced to biopharmaceutical aspects of a variety of dosage forms. They will become familiar with the format of prescriptions and the organization and contents of monographs and their appendices. The application of mathematics to the preparation of prescriptions and drug products will be introduced. The design, preparation, properties, and evaluation of solution dosage forms including incompatibilities will be introduced. Pertinent physical and chemical principles involving solubility, pH effects, selection of excipients (e.g., color, flavor, buffers, preservatives) and their effect on the performance and quality of these dosage forms will be examined. Students will become familiar with oral solutions, ophthalmic solutions and colligative properties. Pharmaceutical Calculations will be emphasized during this course. Students must show mastery of pharmaceutical calculations at the completion of this course.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in (MATH 1031, MATH 1041, or MATH 1941), (CHEM 2202 or CHEM 2922), (CHEM 2204 or CHEM 2924), (BIOL 1111 or BIOL 1911), (BIOL 1112, BIOL 1912, BIOL 2112, or BIOL 2912), (PHYS 1021, PHYS 1061, PHYS 1961, PHYS 2021, or PHYS 2921), (KINS 1222 or KINS 1224), and SCTC 2396.

PS 3162. Pharmaceutics II. 3 Credit Hours.
This is a lecture-based, integrative course on the physical pharmacy principles and dosage forms (both traditional and novel). The description, preparation and product care for the following types of pharmaceutical products (and related dosage forms): parenterals, emulsions, creams, lotions, paste, gel, aerosols, transdermal delivery systems, suppositories, suspensions, tablets and capsules will be covered. Selection of excipients and their effects on performance and quality, chemical incompatibilities among drugs and excipients, drug degradation, surfactants, and pharmaceutical polymers will be discussed. In addition, students will learn the recent fields in pharmaceutical sciences such as nanomedicine and biotechnology.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in PS 3161.

PS 3164. Pharmacology I. 4 Credit Hours.
This course is the first semester of a two-semester sequence. The goal of the course is for students to learn the basic principles of pharmacology which will enhance their ability to apply this knowledge to the practice of pharmacy and communicate their knowledge with other health care professionals. The mechanisms of drug action, absorption, distribution, metabolism, adverse effects, drug interactions, and misuse are covered. Students will apply and integrate pharmacological principles to their other pharmaceutical science courses.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in PS 3145 and PS 3151.

PS 3265. Pharmacology II. 3 Credit Hours.
This course is the second semester of a two-semester sequence. The goal of the course is for students to learn the basic principles of pharmacology which will enhance their ability to apply this knowledge to the practice of pharmacy and communicate their knowledge with other health care professionals. The mechanisms of drug action, absorption, distribution, metabolism, adverse effects, drug interactions, and misuse are covered. Students will apply and integrate pharmacological principles to their other pharmaceutical science courses.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in PS 3164.

PS 3318. Clinical Drug Development. 3 Credit Hours.
This course studies the drug development process from discovery through FDA marketing approval. It reviews the process of development and the interrelationships linking the various disciplines, introducing students to regulations governing the process, including the interactions with FDA, ICH, and other regulatory agencies.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in (MATH 1031, MATH 1041, or MATH 1941), (CHEM 2202 or CHEM 2922), (CHEM 2204 or CHEM 2924), (BIOL 1111 or BIOL 1911), (BIOL 1112, BIOL 1912, BIOL 2112, or BIOL 2912), (PHYS 1021, PHYS 1061, PHYS 1961, PHYS 2021, or PHYS 2921), (KINS 1222 or KINS 1224), and SCTC 2396.

PS 3476. Toxicology and Good Laboratory Practices in Drug Development. 3 Credit Hours.
This entry-level course is specifically designed for undergraduate-level students with no industry experience, introducing them to the roles of pre-clinical toxicology and Good Laboratory Practices (GLPs) in the pharmaceutical drug development process. GLPs refer to the specific regulations and guidances of the U.S. Food and Drug Administration (FDA) that must be followed in the preclinical development of all regulated pharmaceutical products. The established GLPs guidelines focus on: safety pharmacology and LD50; reproductive toxicology; carcinogencity studies; personnel, facilities, and data handling. The first half of the course reviews basic principles of preclinical toxicology studies, including pharmacologic effects, dose-response relationships, types of toxicology studies, and regulatory guidelines for nonclinical toxicity evaluation. Students subsequently explore why GLPs were implemented, how GLPs requirements must be incorporated into the design of preclinical research, and standard practices for documenting GLPs compliance. Since this is an introductory course, time will be spent defining and explaining commonly used industry terminology and acronyms regarding GLPs and toxicology studies.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in PS 3318.

PS 3477. Current Good Manufacturing Practices. 3 Credit Hours.
This course is specifically designed for undergraduate-level students with no industry experience, introducing them to 1) the concept and requirements of the regulated pharmaceutical and biopharmaceutical industries, and 2) the "cGMPs" (or current good manufacturing practices), which refer to the specific regulations and guidances of the U.S. Food and Drug Administration (FDA) that must be followed in the manufacturing of all regulated pharmaceutical products. The course provides an overview of the concepts of "quality assurance," "regulatory affairs," and "compliance" which govern every aspect of the pharmaceutical, biopharmaceutical and related industries which are employed and followed to assure that consistency and quality outcomes are obtained. Since this is an introductory course, time will be spent defining and explaining commonly used industry terminology and acronyms. Class discussions will focus on the regulations for drugs that appear in the Food, Drug and Cosmetic Act (21 CFR 210 and 211), and how these are applied to every aspect of the manufacturing process, including personnel, buildings, equipment, and records. Class workshops will enable students to write and critique the creation of SOPs (standard operating practices) for GMPs and also delve into the consequences if companies are non-compliant with the GMPs.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in PS 3318.

PS 4261. Concepts in Pharmacogenomics. 3 Credit Hours.
The goal of this course is to present the contemporary pharmacogenetic principles applied to the latest innovations in medication therapy. In accordance with this goal, the course overviews genetic factors contributing to drug metabolism and drug response. Here, the emphasis is made on how the genetic makeup of individuals defines the reaction of a human body to drug therapy, with the accent on the relationship between genetic variability and adverse effects of drug therapy. Topics in the course provide a good background to bring together the disciplines of drug metabolism, pharmacogenomics, and clinical pharmacy practice. Basic procedures in pharmacogenetic evaluation of patients will be addressed during the lab exercise. As future pharmacists, it is your primary responsibility to provide pharmaceutical care and have knowledge of therapeutic effects as well as side effects of drugs. You are expected to understand and be able to disseminate/communicate new knowledge about human genome and genetic variability to patients, health professionals, and public health. We hope that students will appreciate the importance of genetic considerations in drug therapy for their future profession.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in PS 3162.

PS 4262. Pharmacokinetics. 3 Credit Hours.
The objective of this course is to present the fundamental principles of pharmacokinetics. The topics will include pharmacokinetic data analysis, dosage regimen design and the determinants of drug absorption, distribution, metabolism, and excretion.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C- in PS 3164.

PS 5451. Statistical Quality Control. 3 Credit Hours.
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. Note: Not open to students who have taken the former PHARMACEUTICS 451.

Repeatability: This course may not be repeated for additional credits.

PS 5471. Biotechnology:Bioprocess Basic. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS 5477. Good Manufacturing Practices. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS 5478. High Purity Water System. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS 5492. Production of Sterile Products. 3 Credit Hours.
This course reviews the theory and practice involved in the preparation of sterile, injectable products, covering formulation, manufacturing, facility requirements, validation and regulatory issues. Upon completion of the course, students will develop an understanding of the routes of administration of injectable drugs and the types of injections, current formulation methods, aseptic manufacturing processes, requirements for sterile manufacturing facilities, and validation, compliance and regulatory issues. Note: Not open to students who have taken the former PHARMACEUTICS 492. Also note that prior to fall 2016, the title of PS 5492 was "Production of Sterile Parenterals."

Repeatability: This course may not be repeated for additional credits.

PS 5493. Sterilization Processes. 3 Credit Hours.
This course surveys sterilization processes used in the pharmaceutical, medical device, in-vitro diagnostic, and biotech industries. Current methods of sterilization are discussed, including thermal, gaseous, radiation, filtration, and aseptic processing. Students learn basic aspects of sterilization science as well as design, review, and audit sterilization validations and processes according to industry practices. Note: Not open to students who have taken the former PHARMACEUTICS 493.

Repeatability: This course may not be repeated for additional credits.

PS 5499. Pharmaceutical Drug Dosage Forms. 3 Credit Hours.
Through an overview of drug dosage form design and manufacturing technology, principles of pharmaceutical processing and pharmaceutical dosage form design (including preformulation and biopharmaceutics) are discussed, including dosage forms such as tablets, capsules, modified dosage forms, semi-solid products, and transdermal delivery systems.

Repeatability: This course may not be repeated for additional credits.

PS 5501. Development of Sterile Products. 3 Credit Hours.
A study of the theory and practice in the development of parenteral products; dosage form design, formulation, solubility/physical pharmacy, excipients, assays, stability, physiochemical properties of biomolecules, delivery systems for controlled/sustained release and manufacturing methods. Note: Not open to students who have taken the former PHARMACEUTICS 501. Also note that prior to fall 2016, the title of PS 5501 was Development - Parenterals."

Repeatability: This course may not be repeated for additional credits.

PS 5575. Regulatory Sciences. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS 8000. Topics in Pharmaceutical Sciences. 1 to 3 Credit Hour.
Topics vary; specific topic(s) announced prior to the start of the semester.

Repeatability: This course may be repeated for additional credit.

PS 8001. Principles of Drug Action/Pharmacokinetics. 3 Credit Hours.
This course presents the fundamental principles of pharmacology, medicinal chemistry, and pharmacokinetics needed to understand their application in drug discovery and developmental processes. The material, presented in an integrated manner, includes the molecular mechanisms of drug action, structure-activity relationships, and the time-course of drug absorption and disposition.

Repeatability: This course may not be repeated for additional credits.

PS 8002. Pharmaceutical Analysis. 3 Credit Hours.
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.

Repeatability: This course may not be repeated for additional credits.

PS 8003. Pharmaceutical Manufacturing I: Preformulation/Formulation. 3 Credit Hours.
Presents techniques relevant to all aspects of preformulation and formulation phases, as well as principles and mechanisms of incompatibility and stability testing.

Repeatability: This course may not be repeated for additional credits.

PS 8004. Solid Dosage Forms - Small Molecules. 3 Credit Hours.
This course focuses on the various solid dosage forms of pharmaceutical products, touching upon the various unit operations involved in their manufacture. Topics will include particle science and technology (mixing, powder flow) and dosage form design and manufacture. This course will provide one with a basic understanding of formulation development and unit operations. The focus will be on solid dosage forms, but semisolids and liquids (including suspensions and emulsions) will be covered as time allows.

Repeatability: This course may not be repeated for additional credits.

PS 8005. Pharmaceutical Biotechnology. 3 Credit Hours.
This course will introduce students to pharmaceutical biotechnology, biophysical and chemical aspects of biotech products, and their pharmaceutical formulations and clinical applications. Amino acids, proteins, peptides, and nucleotides are of particular interest. The principles of pharmaceutical formulations and physicochemical evaluation of formulations will be discussed. Pharmacokinetics of biologics and current analytical methods used in pharmaceutical biotechnology are included. In addition, the course provides an introduction to biopharmaceuticals that encompass a variety of technologies ranging from products derived from natural sources, peptides, therapeutic proteins/monoclonal antibodies, oligonucleotide therapeutics (e.g. antisense, ribozymes, apatmers, siRNA), gene therapy and special issues in drug delivery. The course will begin with a review of the molecular, biochemical, pharmaceutical underpinnings that support each of the technologies and will move into a more detailed discussion of each therapeutic technology. Preclinical and clinical development, safety, efficacy and manufacturing issues will be discussed.

Repeatability: This course may not be repeated for additional credits.

PS 8006. Physical Pharmacy I. 3 Credit Hours.
The emphasis of this course is to form bridge between the concepts of physical pharmacy and the application of pharmaceutical sciences. Students will understand basic aspects of intermolecular forces, physical properties of solutions, ionic equilibria, buffers and isotonic solutions, solubility and partition phenomena, complexation and protein binding, reaction kinetics, mass transport, dissolution phenomena, interfacial phenomena, and rheology. Pharmaceutical applications based on the basic principles will be discussed as well. Students will be expected to be able to apply the basic concepts from this course to typical formulation and stability issues of pharmaceutical dosage forms. A previous course is physical chemistry.

Repeatability: This course may not be repeated for additional credits.

PS 8007. Applied Biopharmaceutics. 3 Credit Hours.
Presents the interrelationships of the physicochemical properties of the drug and the dosage form, to the route of administration and to the rate and extent of systemic absorption. Drug absorption mechanisms, physiological and GIT constraints on dosage form transit and bioavailability, effect of formulation parameters, dissolution methodologies, in-vitro/in-vivo correlation of drug product performance as well as SUPAC, ICH and FDA guidelines on development and approval process will be covered. Formulation strategies for optimum therapeutic outcome via application of pharmaceutical sciences to the design of drug delivery systems is provided.

Repeatability: This course may not be repeated for additional credits.

PS 8008. Advanced Principles of Pharmacokinetics. 3 Credit Hours.
An advanced course in the theory and application of pharmacokinetics and pharmacodynamics.

Repeatability: This course may not be repeated for additional credits.

PS 8009. Advanced Medicinal Chemistry I. 3 Credit Hours.
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.

Repeatability: This course may not be repeated for additional credits.

PS 8011. Advanced Medicinal Chemistry II. 3 Credit Hours.
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.

Repeatability: This course may not be repeated for additional credits.

PS 8012. Radioisotope Methodology. 3 Credit Hours.
Introductory discussion of the characteristics and properties of ionizing radiation, methods of detection (gas ionization, scintillation, both liquid and solid spectroscopy), radiation standards for safety and protection, and basic evaluation of biological hazards and effects.

Repeatability: This course may not be repeated for additional credits.

PS 8013. Pharmacokinetic Principles in Drug Discovery and Development: Small and Large Molecules. 3 Credit Hours.
The course provides basic principles of pharmacokinetics of small as well as large molecule drugs, with expertise to conduct noncompartmental analysis of pharmacokinetic datasets.

Repeatability: This course may not be repeated for additional credits.

PS 8014. In Vitro-In Vivo Extrapolation in Pharmacokinetics. 3 Credit Hours.
The course provides a working knowledge of ADME assays in drug discovery and development of small and large molecules, reaction phenotyping for drug metabolism and transport, basic understanding of permeability, transporter and metabolism assays, and hands-on experience and expertise to scale-up in vitro data to humans.

Repeatability: This course may not be repeated for additional credits.

PS 8015. Mechanism Based Pharmacokinetic-Pharmacodynamic Modeling. 3 Credit Hours.
The course provides a working knowledge of the array of pharmacokinetic and pharmacodynamic model structures frequently used in drug discovery and development, with hands-on experience and expertise in building compartmental and physiologically-based pharmacokinetic models and pharmacokinetic/pharmacodynamic models.

Repeatability: This course may not be repeated for additional credits.

PS 8016. Pharmacokinetic Principles to Meet Regulatory Guidance Requirements. 3 Credit Hours.
The course provides a clear understanding of relevant regulatory guidances, an understanding of comparative guidances across regulatory agencies, and intermediate expertise in designing studies to meet regulatory requirements.

Repeatability: This course may not be repeated for additional credits.

PS 8021. Pharmacology in Drug Discovery. 3 Credit Hours.
This course will provide an understanding of the basic pharmacological principals as they relate to the drug discovery process. Subjects covered will include enzymes, receptors, ion channels, signal transduction and the role of pharmacokinetics in target engagement and biological activity.

Repeatability: This course may not be repeated for additional credits.

PS 8022. Drug Design, Medicinal Chemistry and Screening Science. 3 Credit Hours.
This course will provide a good understanding of the early stage drug discovery process for small molecule therapeutics. Upon completion, the student will have come to understand concepts of structure-activity and structure-property relationships, design structural changes aimed at addressing potency, selectivity and drug-like properties within a drug discovery program and analyze screening data and use it to effectively identify lead series of molecules.

Repeatability: This course may not be repeated for additional credits.

PS 8023. Late-Stage Drug Discovery and Lead Molecule Progression. 3 Credit Hours.
This course will provide an understanding of late-stage drug discovery processes and lead molecule progression in small molecule therapeutics programs. The student will acquire knowledge on how small molecules advance toward IND-enabling studies and how to critically evaluate and critique current literature in the area of late-stage drug discovery. The course will cover subjects such as preclinical safety, toxicology and API manufacturing.

Repeatability: This course may not be repeated for additional credits.

PS 8031. Fundamentals of Precision and Translational Medicine. 3 Credit Hours.
This course will provide a comprehensive understanding of the principals and applications of precision medicine in healthcare. Subjects covered will include genomic and other "omics" technologies, the processes of translational medicine from bench to bedside and the economic and intellectual considerations of precision medicine.

Repeatability: This course may not be repeated for additional credits.

PS 8032. Clinical Implementation of Pharmacogenomics. 3 Credit Hours.
This course will provide a clear understanding of essential genetic concepts and the effect of genetic variability on drug pharmacokinetics and pharmacodynamics. Evidence-based guidelines will be used to develop personalized medicine recommendations.

Repeatability: This course may not be repeated for additional credits.

PS 8033. Advanced Topics in Translational Science and Clinical Trials. 3 Credit Hours.
This course will provide an understanding and the ability to apply the language of clinical trials and translational medicine. The student will come to understand the regulatory frameworks governing clinical trials, be able to apply biostatistics in translational research, develop strategies for utilizing "omics" technologies in clinical trials and use bioinformatic tools to analyze genomic data in clinical studies.

Repeatability: This course may not be repeated for additional credits.

PS 8041. Pharmaceutical Formulation. 3 Credit Hours.
This course provides an understanding of the basic physicochemical principles of drug properties and formulations of pharmaceutical dosage forms and drug delivery. The student will acquire knowledge on formulation design and its applications, formulation strategies, manufacturing processes and quality control methods in compliance with regulatory guidance.

Repeatability: This course may not be repeated for additional credits.

PS 8042. Pharmaceutical Dosage Form Development. 3 Credit Hours.
This course will provide an understanding of the basic principles of the various pharmaceutical dosage forms and their up-to-date designs, applications, formulation strategies, manufacturing processes and quality control methods.

Repeatability: This course may not be repeated for additional credits.

PS 8043. Drug Delivery and Nanotechnology. 3 Credit Hours.
This course will provide an understanding of the basic principles of drug delivery (including delivery of proteins and nucleic acids) and its major biomedical applications, together with the materials, methods and strategies for generation and evaluation of the commonly used drug delivery systems.

Repeatability: This course may not be repeated for additional credits.

PS 8044. Biopharmaceutics and Delivery Systems Evaluation. 3 Credit Hours.
This course will provide an understanding of the principles of biopharmaceutics in delivery system design, release kinetics and significance of bioavailability / bioequivalence of currently marketed Drug Delivery Systems including topical preparations. The student will come to understand how complex delivery systems including nano-systems are formulated, developed, evaluated and administered as well as their benefits and potential toxicity issues.

Repeatability: This course may not be repeated for additional credits.

PS 8051. Seminar in Pharm Science. 1 Credit Hour.
Repeatability: This course may be repeated for additional credit.

PS 8111. Introduction to Toxicology. 3 Credit Hours.
Toxicology is a multi-disciplinary science focused on the adverse effects of chemicals, drugs and environmental agents. In the first part of this course the basic principles of toxicology will be covered, including dose response relationships, mechanisms of toxicity and exposure. In the second part, target organs of toxicity will be presented with an overview of anatomy and physiology of different target organs (e.g. liver, kidney), as well as organ-specific response to toxic insult. In the final segment of the course, students will be exposed to a variety of areas of applied toxicology, including risk assessment, clinical & forensic toxicology, chemical carcinogenesis, reproductive toxicology and the role of toxicology in drug development.

Course Attributes: SI

Repeatability: This course may not be repeated for additional credits.

PS 8121. Department of Pharmaceutical Sciences Seminar Series. 1 Credit Hour.
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 pharmaceutics, 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.

Repeatability: This course may not be repeated for additional credits.

PS 8122. Writing and Publishing a Review Article. 1 Credit Hour.
The purpose of this course is to research, write and submit a manuscript (review article) in English for publication in a refereed scientific journal.

Repeatability: This course may not be repeated for additional credits.

PS 8123. Bioinformatic Genes Drug. 1 Credit Hour.
The course is a one semester Research project focused on inherited factors that modulate drug response. The use of Web-based computer software for data mining, genetic variability in humans, detection and prediction of pharmacologically relevant genetic polymorphisms will be presented. The course is an introductory level course for students involved in research on Pharmacogenomics and Pharmacogenetics.

Repeatability: This course may not be repeated for additional credits.

PS 8125. Journ Club/Pharmacodynam. 1 Credit Hour.
Course aims to keep participants up-to-date on current literature in the field. Participants will present the background, content, and implications of a paper of their choosing to the class. In addition, Temple researchers may present their ongoing research and/or review the current literature in the field. The goals of the course are to: 1) facilitate the sharing of knowledge and discussion of current information and 2) to aid students in the critical interpretation of the literature, and the presentation of the results to their colleagues.

Repeatability: This course may not be repeated for additional credits.

PS 8126. Laboratory Experience in Pharmaceutical Sciences. 1 Credit Hour.
Students enrolled in this course will be mentored by a member of the graduate faculty in the department in order to become familiar with the research area of the instructor and the everyday workings of the laboratory. The techniques, instrumentation, and procedures covered during the semester will vary depending on the concentration o f interest and may include medicinal chemistry/drug discovery, pharmaceutics/pharmacokinetics or pharmacodynamics/pharmacogenomics. Students will be exposed to a wide variety of experimental techniques and analytical instrumentation.

Repeatability: This course may be repeated for additional credit.

PS 8127. Pharmacokinetics. 3 Credit Hours.
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.

Repeatability: This course may not be repeated for additional credits.

PS 8128. Principles in Drug Discovery. 3 Credit Hours.
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.

Repeatability: This course may not be repeated for additional credits.

PS 8129. Bioethics in Research. 2 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS 8131. Principles of Biochemistry. 4 Credit Hours.
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.

Repeatability: This course may not be repeated for additional credits.

PS 8132. Topics in Pharmaceutical Biotechnology. 2 Credit Hours.
This is a seminar course in which students will research and give oral presentations on topics of their choice within the broad subject of pharmaceutical biotechnology.

Repeatability: This course may not be repeated for additional credits.

PS 8133. Introduction to Translational Molecular Technology. 2 Credit Hours.
This is a survey course that will introduce graduate students to important topics in the area of translational research.

Repeatability: This course may not be repeated for additional credits.

PS 8134. Neuroscience of Pain. 2 Credit Hours.
This is a neuroscience course that covers the anatomical and physiologic basis for different forms of pain.

Repeatability: This course may not be repeated for additional credits.

PS 8402. Pharmacodynamics. 3 Credit Hours.
This course covers the theoretical underpinnings and practical aspects of quantitative pharmacology. A key feature of the course is its concentration on the integrated study of a drug's pharmacokinetics (transport to its site of action: including absorption, distribution, biotransformation, and excretion) and its mechanism of action at the site of action. Emphasis is placed on the mathematical foundations of such topics as drug-receptor theory, Schild analysis, Furchgott's method, radioligand binding studies, PK/PD modeling, and isobolographic analysis of drug combinations.

Repeatability: This course may not be repeated for additional credits.

PS 8403. Advanced Pharmacogenomics. 2 Credit Hours.
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.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of C in PS 8131.

PS 8404. Pharmaceutical Sciences Literature Review. 2 Credit Hours.
This course is to expose graduate students to the current literature in Pharmaceutics, Pharmacodynamics and Drug Delivery. The goal of the course is to expose the student to a variety of literature articles pertaining to the physical, biologic, and formulation of pharmaceutical dosage forms. At the end of the course the student should be able to compare and critique articles from several journals common to the area of pharmaceutics, analyze literature articles as to the relevancy the results to the discussion, propose new research based on the current literature article, and be able to write an abstract for a review article based on several publications.

Repeatability: This course may not be repeated for additional credits.

PS 8464. Abuses of Drugs and Chemicals. 3 Credit Hours.
Pharmacology of drugs of abuse and related chemicals, the extent of drug abuse, factors fostering drug abuse, and treatment methods.

Repeatability: This course may not be repeated for additional credits.

PS 8478. Modified Release Dosage Forms. 3 Credit Hours.
The fundamentals involved in various extended release dosage forms and their modification for use in particular dosage formulations. Biopharmaceutical and pharmacokinetic aspects of extended-release dosage forms are discussed as well. Overview of polymeric excipients used in the formulation of extended-release dosage forms. Current commercial products under development will be discussed.

Repeatability: This course may not be repeated for additional credits.

PS 8502. Advanced Pharmacokinetic Modeling I. 2 Credit Hours.
This course will cover drug transport in biological systems and advanced topics in pharmacokinetics and pharmacodynamics. Course will also involve computer methods to derive models and discussion of current literature.

Repeatability: This course may not be repeated for additional credits.

PS 8582. Physical Pharmacy II. 3 Credit Hours.
The rheological behavior of polymer systems will be discussed. The physical chemical properties of proteins and peptides will be presented with formulation applications. This is an advanced course. Physical Pharmacy I is a prerequisite.

Repeatability: This course may not be repeated for additional credits.

PS 8583. Chemical Surfaces & Interfaces. 3 Credit Hours.
Topics: types and structure of surfactant molecules; properties of aqueous and non-aqueous surfactant solutions; foaming; micelle formation and solubilization. Binary systems; tenary systems; surfactant-water-amphiphile. Stabilization of emulsions and of solid/liquid dispersions. Biological applications.

Repeatability: This course may not be repeated for additional credits.

PS 8584. Advanced Drug and Gene Delivery Systems. 3 Credit Hours.
The application of nanometer to micrometer delivery systems for disease management has made tremendous advances in recent years. Products of nanotechnology are expected to revolutionize modern medicine due to their versatility in targeting tissues and controlling the release of drugs. Global initiatives are in place to support nanotechnology and nanomedicine. In this interactive course, students will learn the basic principles of advanced drug and gene delivery and its major biomedical applications. The methods or strategies of preparation and evaluation of the commonly used drug and gene delivery systems will be discussed. In addition, students will present selected focused topics on the novel drug and gene delivery systems under the instructors' guidance.

Repeatability: This course may not be repeated for additional credits.

PS 8592. Food and Drug Law. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS 8603. Dermatopharmaceutics. 3 Credit Hours.
Study of the physiology, biochemistry, immunology, skin permeability, and penetration enhancers as well as role of growth factors in healing after injuries. Semi-solid products, influence of formulation variables and their overall drug release capacities in-vitro and in-vivo will be evaluated. Transdermal, iontophoresis, sonophoresis topics, and bioequivalence/bioavailability of topical preparation will be discussed.

Repeatability: This course may not be repeated for additional credits.

PS 8985. Teaching in Higher Educ. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS 9994. Preliminary Examination Preparation. 1 to 6 Credit Hour.
This course fulfills the continuous enrollment requirement after coursework completion while preparing for the Preliminary examinations.

Repeatability: This course may be repeated for additional credit.

PS 9996. Master's Research. 1 to 6 Credit Hour.
Master's Research course appropriate for students finished with coursework and working with a faculty member on the thesis.

Repeatability: This course may be repeated for additional credit.

PS 9998. Pre-Dissertation Research. 1 to 6 Credit Hour.
This course is appropriate for students finished with coursework and working on their dissertation proposal.

Repeatability: This course may be repeated for additional credit.

PS 9999. Dissertation Research. 1 to 6 Credit Hour.
This course is limited to, and required of, students who have achieved candidacy and are now doing dissertation research.

Repeatability: This course may be repeated for additional credit.

PS P151. Medicinal Chemistry I. 4 Credit Hours.
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.

Repeatability: This course may not be repeated for additional credits.

PS P152. Medicinal Chemistry II. 4 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P155. Principles of Infectious Diseases. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P157. Anatomy/Physiology. 5 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P158. Ant. Infective Agents. 2 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P161. Pharmaceutics I. 3 Credit Hours.
Upon the conclusion of this course students will have been introduced to biopharmaceutical aspects of a variety of dosage forms. They will become familiar with the format of prescriptions and the organization and contents of monographs and their appendices. The application of mathematics to the preparation of prescriptions and drug products will be introduced. The design, preparation, properties, and evaluation of solution dosage forms including incompatibilities will be introduced. Pertinent physical and chemical principles involving solubility, pH effects, selection of excipients (e.g., color, flavor, buffers, preservatives) and their effect on the performance and quality of these dosage forms will be examined. Students will become familiar with Oral solutions, ophthalmic solutions and colligative properties. Pharmaceutical Calculations will be emphasized during this course. Students must show mastery of pharmaceutical calculations at the completion of this course.

Repeatability: This course may not be repeated for additional credits.

PS P162. Pharmaceutics II. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P164. Pharmacology. 4 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P171. Pharmacy Lab I. 1 Credit Hour.
Repeatability: This course may not be repeated for additional credits.

PS P172. Pharmacy Lab II. 1 Credit Hour.
Repeatability: This course may not be repeated for additional credits.

PS P251. Medicinal Chemistry III and Natural Products. 4 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P261. Concepts in Pharmacogenomics. 3 Credit Hours.
The goal of this course is to present the contemporary pharmacogenetic principles applied to the latest innovations in medication therapy. In accordance with this goal, the course overviews genetic factors contributing to drug metabolism and drug response. Here, the emphasis is made on how the genetic makeup of individuals defines the reaction of a human body to drug therapy, with the accent on the relationship between genetic variability and adverse effects of drug therapy. Topics in the course provide a good background to bring together the disciplines of drug metabolism, pharmacogenomics, and clinical pharmacy practice. Basic procedures in pharmacogenetic evaluation of patients will be addressed during the lab exercise. As future pharmacists, it is your primary responsibility to provide pharmaceutical care and have knowledge of therapeutic effects as well as side effects of drugs. You are expected to understand and be able to disseminate/communicate new knowledge about human genome and genetic variability to patients, health professionals, and public health. We hope that students will appreciate the importance of genetic considerations in drug therapy for their future profession.

Repeatability: This course may not be repeated for additional credits.

PS P262. Pharmacokinetics. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P265. Pharmacology II. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P271. Pharmacy Lab III. 1 Credit Hour.
Repeatability: This course may not be repeated for additional credits.

PS P272. Pharmacy Lab IV. 1 Credit Hour.
Repeatability: This course may not be repeated for additional credits.

PS P310. Psych/Clin Sub Abuse. 2 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P381. Emerging Therapeutic Iss. 2 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P382. Practical Chromatography. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P383. Natural Product Analysis. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P384. Writing/Pub Review Artic. 2 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P386. Adv. Clinical Toxicology. 2 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P387. Veterinary Pharmacy. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

PS P389. Research. 1 to 3 Credit Hour.
Repeatability: This course may be repeated for additional credit.