

College of Pharmacy

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Head, Health Services Research

- William R. Doucette

Managing Director, University of Iowa Pharmaceuticals

- Dennis M. Erb

Professional degree: Pharm.D.

Professional certificate: palliative care

Graduate degrees: M.S. in pharmacy; Ph.D. in pharmacy

Faculty: <https://pharmacy.uiowa.edu/people>

Website: <https://pharmacy.uiowa.edu/>

The hallmarks of a University of Iowa pharmacy degree are patient-centered practice, strong grounding in science and evidence-based practice, exploration of career choices through required and elective courses, and exposure to leadership opportunities within the college, the University, and the profession. Career options may include community and/or hospital pharmacy, public service, consulting and long-term care, teaching and research in academia, managed care, pharmaceutical industry, or research careers.

The University of Iowa's Pharm.D. program synthesizes basic scientific principles and practice through caring and communication in an integrated professional program. The role of a pharmacist ranges from managing medication for individuals to shaping national health care policy. Students learn to manage aspects of practice, to solve problems,

make clinical decisions, clearly communicate ideas, practice ethically, and become leaders in their communities and profession. Students study with professors who, in many cases, are pioneering the development of new drugs and defining the appropriate use of others to solve chronic health problems.

The College of Pharmacy Ph.D. program offers four areas of graduate study: pharmaceuticals, clinical pharmaceutical sciences, medicinal and natural products chemistry, and health services research. The major emphasis of these graduate programs is on research and coursework.

The College of Pharmacy collaborates with the College of Public Health to offer the combined Doctor of Pharmacy/ M.P.H. degree, and with the Graduate College to offer the Doctor of Pharmacy/M.S. in informatics degree. In addition, a professional Certificate in Palliative Care also is available.

College Organization

The College of Pharmacy's faculty and programs are organized in two academic units. These units provide coursework for the Doctor of Pharmacy curriculum and for the college's graduate programs.

Pharmacy Practice and Science

Faculty in Pharmacy Practice and Science (PPS) provide expertise and education in the professional practice of pharmacy. They specialize in a wide variety of clinical pharmacy practices; conduct research on patient and population outcomes related to medication therapy; contribute to the scholarship of teaching and learning in pharmacy education; and provide instruction in the pharmacist's professional role and the safe, effective use of medications.

This unit offers Master of Science and Doctor of Philosophy curricula in health services research, which encompasses the behavioral, economic, social, and administrative sciences; and elements of pharmacy practice. It offers coursework through its Applied Clinical Sciences Division and its Health Services Research Division.

Applied Clinical Sciences (ACS) Division

Teaching and research in this division focus on the delivery of care and related services to patients and the education of student and resident pharmacists in practice settings. Courses are offered in pharmacotherapy, communication and practice skill development, clinical problem solving, and patient care. Professional practice mentoring and education are provided in introductory and advanced pharmacy practice experiences.

Health Services Research (HSR) Division

Teaching and research in this division involve economic, social, behavioral, and administrative components of pharmacy practice and medication use. Courses are offered on the health care system, practice management, the professional and business aspects of pharmacy practice, and on learning and applying economic and social psychological theories to the study of health services and medication use.

To learn more about the department and its two divisions, visit Pharmacy Practice and Science on the College of Pharmacy website.

Pharmaceutical Sciences and Experimental Therapeutics

Faculty in Pharmaceutical Sciences and Experimental Therapeutics (PSET) provide expertise and education in areas that include the fundamental basis for drug therapy outcomes in patients, factors responsible for specific drug actions in individual patients and larger patient populations, drug metabolism, pharmaceutical toxicology, organic synthesis, structure-activity relationships, drug design, computer-aided drug discovery, bioanalytical chemistry, biopolymeric drugs, molecular pharmacology, dosage form development and performance, pharmaceutical applications of nanotechnology, industrial and manufacturing pharmacy, pharmacokinetics, and pharmacodynamics.

In addition to its educational roles in the Doctor of Pharmacy program, PSET offers Ph.D. and M.S. degrees in three graduate areas: clinical pharmaceutical sciences, medicinal and natural products chemistry, and pharmaceuticals. Clinical pharmaceutical sciences focuses on investigating drug therapy outcomes in patients and identifying factors responsible for specific drug actions in individual patients, related patient groups, and large patient populations. Medicinal and natural products chemistry includes aspects of drug design, organic synthesis, structure-activity relationships, drug metabolism, pharmaceutical toxicology, computer-aided drug discovery, bioanalytical chemistry, biopolymeric drugs, and molecular pharmacology. Pharmaceuticals focuses on characterization of pharmaceuticals and their component materials, development of new dosage forms and drug delivery systems, pharmaceutical applications of nanotechnology, and the pharmacokinetic and pharmacodynamic evaluation of drug actions and interactions.

The department also offers multidisciplinary opportunities with programs in medicine, chemistry, biochemistry, pharmacology, engineering, dentistry, and public health. Its national and international collaborations further enhance the breadth of research activities available to students.

To learn more, visit Pharmaceutical Sciences and Experimental Therapeutics on the College of Pharmacy website.

Programs

Professional Programs of Study

Major

- Doctor of Pharmacy

Certificate

- Certificate in Palliative Care

Graduate Programs of Study

Majors

- Master of Science in Pharmacy
- Doctor of Philosophy in Pharmacy

Facilities

Pharmacy Building

A new, state-of-the-art building has set the stage for advancements in science and discovery, and for world-

class pharmacy education to continue to grow and thrive. Classroom space is designed for collaborative and hands-on learning. The building boasts 16 collaborative research spaces and 23 learning spaces—centers and team rooms with aspects of universal design. In addition, the college has added 16,000 square feet of manufacturing space with a sterile products processing facility.

The original facility, now called the Pharmaceutical Sciences Research Building, continues to house classrooms, labs, offices, and a manufacturing facility.

The College of Pharmacy is located on the University's health sciences campus in close proximity to five professional schools. Students collaborate with expert health care providers at the Carver College of Medicine, and at the Colleges of Dentistry, Nursing, and Public Health. The College of Pharmacy is located in close proximity to University of Iowa Hospitals & Clinics, the Bowen Science Building, and the Hardin Library for the Health Sciences.

For more than 125 years, the University of Iowa College of Pharmacy has led the way in educating pharmacists and pharmaceutical scientists. The college is well known for its high quality pharmacy education, advanced practice models, patient care, drug discovery, product development, and contract manufacturing.

University of Iowa Pharmaceuticals

University of Iowa Pharmaceuticals is a pharmaceutical manufacturing facility registered with the U.S. Food and Drug Administration that develops pharmaceutical dosage forms and has manufactured clinical supplies in compliance with Good Manufacturing Practices since 1974. University of Iowa Pharmaceuticals has clients worldwide, including pharmaceutical companies, biotechnology firms, medical departments, and government agencies. Its staff works closely with clients and pharmaceuticals faculty members to produce virtually every type of pharmaceutical dosage form, supplying new pharmaceutical agents for use in clinical trials and other research. For more information, visit the University of Iowa Pharmaceuticals website.

Courses

Students must be enrolled in the College of Pharmacy to enroll in professional-level (Pharm.D.) coursework numbered 8000-9999. Students who meet prerequisite requirements may register for the college's undergraduate- and graduate-level courses numbered 1100-7999.

College of Pharmacy Courses

PHAR:1000 First-Year Seminar 1 s.h.

Small discussion class taught by a faculty member; topics chosen by instructor; may include outside activities (e.g., films, lectures, performances, readings, visits to research facilities).

PHAR:1100 Introduction to Pharmaceutical Sciences: Drug Development 1-2 s.h.

Introduction to drug discovery, development, and approval pathways used in the United States; specific focus on career pathways related to pharmaceutical development including the natural and biomedical sciences, clinical, regulatory and legal affairs, sales and marketing, and business development.

PHAR:1111 Need a New Drug?**1 s.h.**

Introduction to drug discovery, development, and approval process in the United States; focus on preclinical and clinical development activities and role of the FDA and other regulatory bodies in approval and oversight of available drug products.

PHAR:1200 Medicines That Changed the World**1 s.h.**

Herbal remedies and ancient traditional medicines have led to the discovery of life-saving drug therapies; as science has evolved, how the discovery of other important medicines have come about through advances in chemistry and biology and now through advances in computer science and informatics; students learn about the discovery history of some of the most important drug therapies of the 20th and 21st centuries and how those discoveries are leading to even more important, life-saving treatments.

PHAR:1812 What's in My Medicine Cabinet? An Introduction to Over-the-Counter Medications and Self Care**2 s.h.**

Introduction to nonprescription medications for treatment of minor illness and health maintenance; causes, signs, and symptoms of common ailments with information about selection of appropriate over-the-counter therapies and considerations for the need for further care; self-care strategies for disease prevention and wellness.

PHAR:3994 Undergraduate Research in Pharmaceutical Sciences**1-4 s.h.**

Individual scientific research conducted under the guidance of a faculty member.

PHAR:3995 Undergraduate Independent Study**1-4 s.h.**

Supervised study. Requirements: enrollment in College of Pharmacy undergraduate certificate program.

PHAR:4146 Drug Disposition and Pharmacokinetics**2 s.h.**

Introduction to drug absorption, distribution, and elimination processes controlling overall drug exposure in humans; basic quantitative measurements presented and used to demonstrate the influence of drug properties and physiological action on drug disposition. Prerequisites: (MATH:1380 or MATH:1460 or MATH:1550 or MATH:1850) and (BIOL:1140 or BIOL:1141 or BIOL:1411 or BIOL:1412) and (STAT:1020 or PSQF:1020 or STAT:1030 or STAT:2010).

PHAR:4501 Basic Principles of Toxicology**3 s.h.**

Basic principles and mechanisms of toxicology as it relates to drugs and environmental agents. Prerequisites: BIOC:3110.

PHAR:4512 Principles of Drug Discovery**3 s.h.**

Focus on understanding drug targets as receptors, receptor theory, drug discovery, and new drug approval processes; areas of novel drug target identification, pharmacological characterization of new drugs, G protein coupled receptors as targets, and analysis of drug-receptor interactions. Prerequisites: BIOC:3110. Recommendations: one semester of pharmacology.

PHAR:4521 High Throughput Screening in Drug Discovery**1 s.h.**

Introduction to high throughput screening (HTS) and its application in pharmaceutical and biomedical sciences; description and use of HTS in identification of biologically active small molecules for use as probes, tool compounds, and drug leads; detection systems, robotic liquid handling instruments, and compound libraries; case studies of HTS approaches used in drug discovery. Prerequisites: ((CHEM:2220 or CHEM:2240) and BIOC:3110) or (BIOC:3120 and BIOC:3130). Requirements: one semester of analytical chemistry or analytical biochemistry.

PHAR:4537 Principles of Drug Metabolism**3 s.h.**

Principles of drug metabolism based on current knowledge of involved enzymes. Prerequisites: (CHEM:2220 or CHEM:2240) and (BIOC:3120 or BIOC:3110).

PHAR:4700 Pharmaceutical Chemical Analysis**4 s.h.**

Introduction to the use and selection of analytical methods used to evaluate pharmaceutical products; basic laboratory skills, data analysis, and record keeping. Prerequisites: (CHEM:2220 or CHEM:2240) and (CHEM:2410 or CHEM:2420). Requirements: no prior enrollment in PHAR:5700.

PHAR:4736 Properties of Dosage Forms I**3 s.h.**

Introduction to principles of physical and chemical sciences important in drug product development; solubility, colligative properties, and partitioning behavior, as well as ionic equilibria, pH control, and chemical stability are evaluated in context of their importance in liquid dosage forms; emphasis on issues impacting drug product quality. Prerequisites: (CHEM:2220 or CHEM:2240) and (MATH:1460 or MATH:1380 or MATH:1550 or MATH:1850).

PHAR:4737 Properties of Dosage Forms II**3 s.h.**

Physical and chemical properties and measurements of materials used in pharmaceuticals; introduction to material properties of drugs and excipients used in development of semi-solid and solid pharmaceuticals; emphasis on material selection, dosage form performance characteristics, and evaluation of drug product quality. Prerequisites: PHAR:4736.

PHAR:4740 Materials in Drug and Gene Delivery**3 s.h.**

Different types of materials used in drug and gene delivery including synthetic and natural polymers (poly lactic-co-glycolic acid and chitosan respectively); different forms of delivery systems including (but not limited to) liposomes, micelles, biodegradable nanoparticles, nondegradable nanoparticles, and solid porous scaffolds; applications of these material-based delivery systems from targeted chemotherapy to bone regeneration to vaccination applications.

PHAR:4741 Immunology and Immunotherapies**2 s.h.**

Introduction to basics of the immune system and how it protects against infection and disease; in-depth lectures on vaccines against infectious diseases and cancer in terms of their formulations and how they work; focus on past seminal findings, current treatment modalities, and cutting-edge technologies likely to impact future immunotherapeutic strategies.

PHAR:4745 Drug Delivery I**arr.**

Advanced design and development of drug delivery systems; emphasis on selection of materials and designs suitable for specific applications; comparison and evaluation of available and emerging technologies. Prerequisites: (BIOC:3110 or BIOC:3120) and (MATH:1460 or MATH:1550 or MATH:1850 or MATH:1380) and (CHEM:2220 or CHEM:2240) and PHAR:4737. Corequisites: PHAR:4146 (if not taken as a prerequisite). Requirements: one semester of human physiology.

- PHAR:4799 Special Topics in Pharmaceutics** arr. 1 s.h.
Current topics in pharmaceutics. Prerequisites: MATH:2560 and CHEM:4431.
- PHAR:4800 Chemical and Biophysical Properties of Drugs** 1 s.h.
Introduction to design of drug molecules based on an understanding of drug-like properties including chemical reactivity and structural optimization; minimization of potentially toxic biotransformations; optimization of absorption; screening methods for selection and classification of optimized molecules. Prerequisites: ((CHEM:2220 or CHEM:2240) and BIOC:3110) or (BIOC:3120 and BIOC:3130).
- PHAR:4850 Upstream Biotechnology Processes** 2 s.h.
Introduction to fermentation, fermenter preparation, cell growth and medium requirements, inoculation, sampling, process termination, separation of cells, fermentation case study, enzyme activity, and biocatalysis. Same as CHEM:4850.
- PHAR:4851 Radiopharmaceuticals in Diagnostics and Therapy** 2 s.h.
Use of radionuclides for diagnosis and monitoring of disease and in development of new therapeutic agents; strategies for provision of effective agents, regulatory processes, and safe handling and administration. Prerequisites: CHEM:2220 or CHEM:2240. Recommendations: one semester of physics, one semester of biology, one semester of anatomy or physiology, and one semester of pharmacology.
- PHAR:5110 Clinical Pharmaceutical Sciences Seminar** 1-2 s.h.
Research by faculty, graduate students.
- PHAR:5310 Health Services Research Seminar** 1-2 s.h.
Recent research in pharmacy administration.
- PHAR:5350 Introduction to Research Methods** 3 s.h.
Scientific inquiry, experimental design, data collection, statistical methods used in the study of health services and clinical investigations; focus on understanding the research process and evaluating published studies. Recommendations: introductory statistics.
- PHAR:5360 Applied Research Methods: Primary Data** 3 s.h.
Advanced topics in research methods; focus on primary data collection and analysis; qualitative, mixed, survey, and intervention research methods with focus on applying these methods to topics in pharmacy health services research. Prerequisites: PHAR:5350.
- PHAR:5365 Applied Research Methods: Secondary Data** 3 s.h.
Advanced topics in research methods applicable to common sources of secondary data; hands-on experience writing programs to prepare and analyze various health-related data using common statistical software packages (e.g., SAS, STATA, R). Prerequisites: PHAR:5350.
- PHAR:5400 Principles of Pharmacogenomics** 3 s.h.
Fundamental knowledge of molecular biology and relationship to pharmacological agents; working knowledge of DNA, RNA, and protein changes that occur to influence gene expression; how pharmacological agents can impact biological mechanisms and how this can impact treatment response; requirements to design and carry out an experiment in human and animal models to study specific biological mechanisms; critical evaluation of published scientific literature to describe cutting-edge pharmacological findings in this field. Requirements: graduate standing in pharmacy (clinical pharmaceutical sciences, pharmaceutics, medicinal chemistry), neuroscience, pharmacology, or toxicology.
- PHAR:5510 Pharmaceutical Sciences and Experimental Therapeutics Seminar** 1-2 s.h.
- PHAR:5512 Drug Discovery and Mechanisms** 3 s.h.
Process of modern drug discovery, focus on high throughput screening strategies, target validation, pharmacological characterization of new compounds; mechanism of drugs targeting G protein coupled receptors, ion channels and transporters, targets in biological systems.
- PHAR:5515 Perspectives in MNPC Research** 2 s.h.
Contemporary research in medicinal chemistry and natural products.
- PHAR:5520 Medicinal and Natural Products Chemistry Research** arr.
- PHAR:5521 High Throughput Screening for Pharmaceutical and Biomedical Sciences** 1 s.h.
Broad introduction to high throughput screening (HTS) and its application in pharmaceutical and biomedical sciences; HTS as a modern technology platform integrated with robust detection systems and robotic liquid handling instruments; use of HTS platforms to identify biologically active small organic molecules to validate drug targets, screen compound libraries; identification of biologically active small molecules for use as probes, tool compounds, drug leads; systematic, unbiased, and/or focused hypothesis-based approaches for mechanistic studies in biological and medical sciences. Recommendations: bachelor degree in biochemistry, chemistry, molecular biology, pharmacology, or equivalent.
- PHAR:5525 Drug Delivery Systems for Insoluble Compounds** 3 s.h.
Specialized disperse systems (e.g., emulsions, nanoemulsions, microemulsions, micelle) used for insoluble systems; introduction to basics of lipid systems to understand behavior in aqueous media when delivered to the body.
- PHAR:5530 Pharmaceutical Sciences and Experimental Therapeutics Seminar** 1-2 s.h.
- PHAR:5537 Enzymatic Basis of Drug Metabolism** 3 s.h.
Current literature on catalytic and physical properties, distribution, and substrate specificity of enzymes involved in mammalian drug metabolism. Prerequisites: CHEM:2220.
- PHAR:5541 Total Synthesis of Biologically Active Natural Products** 3 s.h.
Total synthesis of natural products; use of strategies and tactics for synthetic maneuvering; selectivity of important and complex medicinal compounds; modern chemical methods for construction of carbon-carbon bonds.
- PHAR:5542 Molecular Recognition** 1 s.h.
Focus on determinants in protein small molecule binding, particularly involving pharmaceutically relevant enzymes and receptors; how modern structure-based drug discovery is greatly aided by ability to employ protein structures in discovery and design of certain classes of drugs; structural approaches for predicting and improving drug affinity and selectivity, which have made a lasting impact across a number of diseases; important contemporary topics include in-depth lectures on fragment based drug discovery (FBDD), use and pitfalls of in silico docking and other screening methods, and emergence of covalent drugs. Requirements: introductory course in biochemistry. Same as BMB:5244.
- PHAR:5545 Current Medicinal Chemistry** 3 s.h.
Modern techniques used in drug discovery; important drug classes, their chemical mechanism of action.

- PHAR:5549 Analytical Biochemistry** 3 s.h.
Application of modern chromatographic and detection methods used to isolate, characterize, and quantify drugs and macromolecules.
- PHAR:5700 Quantitative Research Methods in Pharmacy I** 3-4 s.h.
Collection and interpretation of analytical data; instrumental analysis and separation techniques.
- PHAR:5702 Clinical Pharmacokinetics** 2 s.h.
Fundamental concepts in pharmacokinetics and pharmacodynamics; application in dose regimen optimization and rational drug use.
- PHAR:5720 Pharmaceutical Materials and Analysis** 3 s.h.
Strong working knowledge in pharmaceutical solids; different types of solid phases, preparation, and methods of characterization in context of optimizing phase selection with respect to solubility, stability, and processability.
- PHAR:5745 Drug Delivery: Principles and Applications I** arr.
Advanced design and development of drug delivery systems with emphasis on selection of materials and designs suitable for specific applications; comparison and evaluation of available and emerging technologies. Prerequisites: (BIOC:3110 or BIOC:3120) and (MATH:3600 or MATH:2560) and (CHEM:2220 or CHEM:2240) and PHAR:4737. Corequisites: PHAR:4146 (if not taken as a prerequisite). Requirements: one semester of human anatomy and physiology.
- PHAR:5800 Concepts in Preclinical Drug Development** 1 s.h.
Topics relevant to preclinical phase and early clinical stage of drug development; role of drug transporters in drug absorption, distribution, elimination; use of in vitro systems to evaluate drug metabolism, how to use in vitro metabolism data to predict drug clearance in humans; use of animal rule in drug development; biopharmaceutical classification system (BCS) and bioequivalence; biosimilar; use of minimum anticipated biological effect level (MABEL) to determine first-in-human (FIH) dose of protein drugs; drug-drug interaction including basic enzyme kinetics and inhibition (competitive, noncompetitive, uncompetitive); for students seeking to work in pharmaceutical industry.
- PHAR:5875 Perspectives in Biocatalysis** 1-3 s.h.
Applied enzymology, protein design, structure-activity relationships, biosensor technology, microbial transformations, biodegradation of environmental pollutants. Requirements: graduate standing in a participating department supported by the Predoctoral Training Program in Biotechnology. Same as BMB:5875, CBE:5875, CEE:5875, CHEM:5875, MICR:5875.
- PHAR:6120 Clinical Pharmaceutical Sciences Research** arr.
- PHAR:6305 Foundation Literature in Health Services Research** arr.
Issues related to pharmacy administration, social and behavioral pharmacy, pharmacy education.
- PHAR:6320 Health Services Research** arr.
- PHAR:6330 Models of Patient Behavior and Choice** 3 s.h.
Theoretical models used to describe behavior and choice in pharmaceutical socioeconomic research; models from economics, health services research, health behavior, clinical decision making.
- PHAR:6331 Models of Provider Behavior and Choice** 3 s.h.
Theoretical background for study of provider decision making and behavior; models based on a classic economic approach, models used to study provider behavior.
- PHAR:6501 Principles and Mechanisms of Chemical Toxicology** 3 s.h.
General principles and basic mechanisms of chemical and pharmaceutical toxicology; drug/toxicant disposition, including biotransformation and bioactivation to electrophiles.
- PHAR:6504 Mastering Reproducible Science** 1 s.h.
Training in methods for conducting rigorous and reproducible science; features an array of faculty who provide lectures and discussions based on their areas of expertise (i.e., research with animals, synthetic chemistry, high throughput screening, etc.) to provide broad exposure and training in these areas; critical evaluation of literature outside of student's own specific field of study.
- PHAR:6700 Advanced Pharmacokinetics and Pharmacodynamics** 3 s.h.
Application of pharmacokinetics and pharmacodynamics principles in pharmaceutical research. Prerequisites: PHAR:8146 or PHAR:4146. Requirements: two semesters of calculus and one semester of statistics.
- PHAR:6706 Equilibria Processes** 3 s.h.
Equilibria pertaining to ionic systems, complexation, partitioning, solubility. Prerequisites: CHEM:2220 or CHEM:2240.
- PHAR:6710 Pharmaceutics Graduate Seminar** 1-2 s.h.
- PHAR:6720 Pharmaceutics Research** arr.
- PHAR:7101 Principles of Experimental Therapeutics** 3 s.h.
Introduction to key principles and concepts for research in experimental therapeutics; basic principles related to drug disposition, toxicity, and efficacy.
- PHAR:7102 Applied Clinical and Translational Science** 3 s.h.
Application of clinical and translational science in a multidisciplinary collaborative environment to develop, conduct, and report research.
- PHAR:7331 Analytic Issues in Health Services Research II** 3 s.h.
Continuation of HMP:7960; advanced applications, including panel data and qualitative response models. Prerequisites: HMP:7960. Same as HMP:7965.
- PHAR:7701 Surface Phenomena** arr.
Behavior of matter in phase boundaries, especially adsorptive processes at liquid-solid and vapor-solid interfaces. Prerequisites: CHEM:4431.
- PHAR:7703 Transport Phenomena** 3 s.h.
Diffusion and mass transport phenomena related to pharmaceutical systems.
- PHAR:8130 Foundations of Pharmacy Practice I** 4 s.h.
Introduction to contemporary pharmacy practice; small-group discussion, application of core concepts through active hands-on learning approaches; for first-year student pharmacists. Requirements: P1 standing.

- PHAR:8131 Engagement: Professional Skills and Values** 1 s.h.
Opportunity for student engagement in the College of Pharmacy prior to Professionalism Ceremony; development as a responsible partner in learning process by nurturing collaboration, leadership, service, compassion, community, self development, and social enrichment among students, faculty, and staff. Requirements: P1 standing.
- PHAR:8132 Continuing Professional Development** 1 s.h.
Engagement with profession of pharmacy and community through service and leadership activities, reflection; use of Continuous Professional Development Cycle (CPD) approach to learning. Requirements: P3 standing.
- PHAR:8133 Introductory Pharmacy Practice Experience Career Exploration** 1 s.h.
Hands-on exposure to various pharmacist career opportunities in four different pharmacy practice patient care settings; settings include practice areas and rotation types required for P4 Advanced Pharmacy Practice Experience (APPE) sites in community pharmacy, hospital pharmacy, ambulatory care/family practice, acute care medicine, and other elective practice settings; work with faculty mentor. Requirements: P1 standing.
- PHAR:8134 Foundations of Health Services** 3 s.h.
Foundation issues for pharmacist practice related to social, cultural, behavioral, economic, and organization design components of pharmacy care. Requirements: P1 standing.
- PHAR:8135 Health Information Retrieval and Informatics** 3 s.h.
Introduction and overview of health care information retrieval, organization, and dissemination; retrieval and organization of health information from pharmacy and medical primary and tertiary literature using secondary resources; knowledge and skills to manage, analyze, and legally share health information in electronic health records, pharmacy information systems, and automated systems. Requirements: P1 standing.
- PHAR:8136 Foundations of Pharmaceutical Sciences** 6 s.h.
Introduction and overview of foundations of pharmaceutical sciences. Requirements: P1 standing.
- PHAR:8140 Foundations of Pharmacy Practice II** 4 s.h.
Introduction to contemporary pharmacy practice for first-year student pharmacists; classroom methods include small group discussion-based and active hands-on learning approaches where students will apply core concepts.
- PHAR:8148 Pharmacokinetics and Dose Optimization** 2 s.h.
- PHAR:8149 Foundations of Pharmacology and Toxicology** 3 s.h.
Principles of pharmacology and toxicology.
- PHAR:8150 Foundations of Health, Wellness, and Disease** 2 s.h.
Overview of basic processes of good health and practices that promote wellness; emphasis on mechanistic causes of human disease.
- PHAR:8151 Discovery I: Introduction and Background** 3 s.h.
Creation and dissemination of new knowledge related to pharmacy or health care; broadly based scholarly effort with topics ranging from patient case studies, literature reviews, and analysis of pharmacy practice problems or basic research.
- PHAR:8152 Fundamentals of Compounding** 1 s.h.
Introduction to personalized drug delivery systems through the art of compounding. Requirements: P1 standing.
- PHAR:8153 Integrated Pharmacotherapy: Dermatology and Sensory** 2 s.h.
Key elements of science and practice of pharmacy presented in an integrated manner and focused on particular organ systems or disease states. Requirements: P1 standing.
- PHAR:8207 Introductory Pharmacy Practice Experiences Community** 3 s.h.
Exposure to the provision of care in a community pharmacy setting; activities focus on those experiences related to the community pharmacy environment, medication distribution, special products and populations, and related professional activities; delivered in set time blocks over winter break and during summer session before or after the P2 year.
- PHAR:8209 Introductory Pharmacy Practice Experiences Hospital** 3 s.h.
Exposure to the provision of care in a hospital pharmacy setting; activities focus on those experiences related to the hospital pharmacy environment, medication distribution, special products and populations, and related professional activities.
- PHAR:8250 Applications of Pharmacy Practice I** 2 s.h.
Expands on skills and concepts taught in the foundations of pharmacy practice course series and includes skills relevant to the disease states in the specific aligned component courses; taught using a variety of classroom methods including small-group, discussion-based, and active hands-on learning approaches where students will apply core concepts. Requirements: P2 standing.
- PHAR:8252 Integrated Pharmacotherapy: Musculoskeletal** 4 s.h.
Key elements of the science and practice of pharmacy presented in an integrated manner focused on particular organ systems or disease states.
- PHAR:8253 Integrated Pharmacotherapy: Genitourinary and Reproductive** 3 s.h.
Key elements of the science and practice of pharmacy presented in an integrated manner focused on particular organ systems or disease states.
- PHAR:8254 Integrated Pharmacotherapy: Endocrine** 3 s.h.
Key elements of the science and practice of pharmacy presented in an integrated manner focused on particular organ systems or disease states.
- PHAR:8255 Discovery II: Design and Methods** arr.
Create and disseminate new knowledge related to pharmacy or health care with emphasis on design methods and data collection.
- PHAR:8256 Integrated Pharmacotherapy: Renal, Fluids, and Electrolytes** 2 s.h.
Key elements of the science and practice of pharmacy presented in an integrated manner; focus on particular organ systems or disease states.
- PHAR:8260 Integrated Pharmacotherapy: Cardiovascular** 4 s.h.
Key elements of the science and practice of pharmacy presented in an integrated manner focused on particular organ systems or disease states.

PHAR:8261 Integrated Pharmacotherapy: Neurology and Psychiatry 4 s.h.

Key elements of the science and practice of pharmacy presented in an integrated manner focused on particular organ systems or disease states.

PHAR:8263 Integrated Pharmacotherapy: Infectious Diseases 4 s.h.

Key elements of the science and practice of pharmacy presented in an integrated manner focused on particular organ systems or disease states.

PHAR:8264 Discovery III: Data Collection and Results 1 s.h.

Create and disseminate new knowledge related to pharmacy or health care with emphasis on data collection and results.

PHAR:8265 Applications of Pharmacy Practice II 2 s.h.

Expands on skills and concepts taught in the foundations of pharmacy practice course series and includes skills relevant to the disease states in the specific integrated pharmacotherapy courses; taught using a variety of classroom methods including small group, discussion-based, and active hands-on learning approaches where students apply core concepts.

PHAR:8301 Introductory Pharmacy Practice Experience Clinical 1 s.h.

This third IPPE clinical is completed as an introduction to the Advanced Pharmacy Practice Experiences (APPE) to which student pharmacists are exposed during their P4 year; the IPPE clinical involves a P3 student observing and participating with a P4 student currently on an APPE rotation.

PHAR:8370 Integrated Pharmacotherapy: Respiratory and Allergy 3 s.h.

Key elements of the science and practice of pharmacy presented in an integrated manner focused on particular organ systems or disease states.

PHAR:8371 Integrated Pharmacotherapy: Oncology and Hematology 3 s.h.

Key elements of the science and practice of pharmacy presented in an integrated manner focused on particular organ systems or disease states.

PHAR:8372 Integrated Pharmacotherapy: Gastroenterology and Nutrition 3 s.h.

Key elements of the science and practice of pharmacy presented in an integrated manner focused on particular organ systems or disease states.

PHAR:8373 Integrated Pharmacotherapy: Renal, Fluids, and Electrolytes 2 s.h.

Key elements of the science and practice of pharmacy presented in an integrated manner focused on particular organ systems or disease states.

PHAR:8374 Applications of Pharmacy Practice III 2 s.h.

Expands on skills and concepts taught in the foundations of pharmacy practice course series and includes skills relevant to the disease states in the specific aligned component courses; taught using a variety of classroom methods including small group, discussion-based, and active hands-on learning approaches where students apply core concepts.

PHAR:8375 Advanced Topics in Health Services 2 s.h.

Exploration of advanced topics in health service.

PHAR:8376 Discovery IV: Presentation of Results 1 s.h.

Dissemination and presentation of new knowledge related to pharmacy or health care with emphasis on design methods and data collection.

PHAR:8377 Integrated Pharmacotherapy: Capstone 4 s.h.

Capstone serves as a culminating academic and research project for students and mentors, integrating all areas of professional discovery.

PHAR:8378 Pharmacy Law and Ethics 2 s.h.

Topics include ethical behavior for pharmacists and student of pharmacy law.

PHAR:8379 Advanced Pharmacy Practice Experiences Preparation 1 s.h.

Guidance provided for advanced pharmacy practice experiences.

PHAR:8387 Capstone: Skills-Based Assessment 1 s.h.

Further development of assessment skills.

PHAR:8402 Pharm.D. Learning Portfolio II 1 s.h.

Students continue to demonstrate and document mastery of experiential and didactic coursework and assignments, as well as self-assessment of progression. Requirements: P4 standing.

PHAR:8500 Advanced Drug Literature Evaluation and Application 2 s.h.

Critical evaluation, utilization, and clinical application of drug literature.

PHAR:8501 Introduction to Nuclear Pharmacy 2 s.h.

Nuclear pharmacy as a specialty area of pharmacy practice that involves preparation of radioactive materials for patient administration.

PHAR:8502 Advanced Pharmacopalliation of Pain 2 s.h.

Exploration of symptom management across the trajectory of serious illness through a series of longitudinal patient cases.

PHAR:8503 Advanced Pharmacopalliation of Non-Pain Symptoms 3 s.h.

Terminal extubation, terminal agitation, discontinuing life sustaining therapies, and pharmacokinetic and pharmaceutical issues in advanced illness.

PHAR:8504 Sustained Clinical Pharmacy Services 2 s.h.

Pharmacists may find themselves needing to justify their salary, the cost effectiveness of their pharmacy services, or may wish to create a new clinical service; introduction to pharmacists' role in initiating and sustaining clinical services in the ambulatory setting; writing a business plan; identifying and communicating with key stakeholders; finding billable opportunities.

PHAR:8505 Advanced Topics in Infectious Disease, HIV, and Antimicrobial Therapy 2 s.h.

Topics in antimicrobial treatment of infectious diseases beyond those in the required pharmacy curriculum, including topics covered in the infectious disease therapeutics course; lectures, case discussion, class participation, and summary presentations of an uncommon organism or antimicrobial agent.

PHAR:8506 Health Informatics Essentials 2 s.h.

Health informatics as a multidisciplinary field that uses health information technology to improve health care services for patients.

PHAR:8507 Personal and Professional Transformation 2 s.h.

How to maximize personal and professional goals; focus on what students want to achieve in their personal and professional life.

- PHAR:8508 Interprofessional Case Studies** 2 s.h.
Interdisciplinary collaboration to formulate pharmacologic treatments of common diseases; case-based learning utilized with peer teaching; medical and pharmacy students revisit and share foundational science concepts from their disciplines, including mechanisms of health and disease and principles of pharmacokinetics and pharmacodynamics; discussions led by students and facilitated with a Carver College of Medicine clinician and a College of Pharmacy clinical pharmacist; students formulate treatment plans using the World Health Organization's six step approach to good prescribing. Requirements: P3 standing.
- PHAR:8509 Leaders Read: A Book Club Elective** 2 s.h.
Introduction to concepts from *The Five Practices for Exemplary Leaders* by Kouzes and Posner; overview of all five practices with focus on first practice of "Modeling the Way;" values and skills of servant leadership through reading, reflection, and discussion; servant leadership philosophy where the main goal of the leader is to serve, and exploration of why servant leadership is critical; students articulate their own "why" and the importance of service in leadership.
- PHAR:8510 Pediatric Elective** 1 s.h.
Overview of pediatric developmental differences, disease state medication issues, and clinical decision skills specific to pediatric population. Requirements: P3 standing.
- PHAR:8511 Introduction to Specialty Pharmacy** 2 s.h.
Introduction to the rapidly growing field of specialty pharmacy; weekly interactive classes; students spend time in a specialty pharmacy environment and specialty clinic with a clinical pharmacy specialist to gain knowledge and understanding of clinical, business, distributive, and managed care aspects of specialty pharmacy. Requirements: P2 or P3 standing.
- PHAR:8512 Advanced Drug Literature I: Study Design, Evaluation, and Interpretation** 1 s.h.
Expansion of concepts introduced in the first pharmacy discovery course; improvement of knowledge and skills for practical evaluation of drug literature; emphasis on understanding advanced concepts in study designs which aid in applied interpretation and application of study findings to patient care.
- PHAR:8513 Advanced Drug Literature II: Evaluation and Clinical Application** 1 s.h.
Expansion of concepts introduced in first professional discovery course; improvement of knowledge and skills in practical evaluation of drug literature; emphasis on applied interpretation and application of study findings to patient care through active student journal club presentations and facilitation by faculty content experts. Prerequisites: PHAR:8512.
- PHAR:8706 Pharmacy Projects** arr.
Basic and applied research problems of pharmaceutical interest.
- PHAR:8708 Substances of Misuse** 2 s.h.
Emphasis on the most important themes and concepts in the field of substance use and treatment; drugs of misuse including stimulants, opioids, sedative-hypnotics, alcohol, hallucinogens, marijuana, and performance enhancing compounds; drug use prevention and treatment; depiction of substance use in modern culture.
- PHAR:8709 Pharmacist Role in Health Coaching and Nutrition** 2 s.h.
Exploration of pharmacist role in health coaching and nutrition.
- PHAR:8712 Nonprescription Pharmacotherapy and Self-Care** 2 s.h.
Introduction to nonprescription medications; development of patient assessment and consultation skills; understanding of pharmacist's role in patient self-care. Requirements: P3 standing.
- PHAR:8717 Ambulatory Care Pharmacy** 2 s.h.
Additional experience in the practice of clinical pharmacy; focus on key therapeutic areas where ambulatory care clinical pharmacists currently have a significant impact improving patient care, including anticoagulation management, hyperlipidemia management, and diabetes management; opportunity to develop expertise in clinical decision making, improve problem solving abilities, and continued development in writing and oral presentation skills. Requirements: P3 standing.
- PHAR:8718 Special Topics in Acute Care** 2 s.h.
Pharmacotherapy for common but varied inpatient medicine topics; review of disorder, therapeutic goals, treatment plans, patient education, monitoring; lecture or case-based classes; anticoagulation, hemostasis, diabetic ketoacidosis, ICU overview, hepatic failure, renal replacement therapies, ACLS, antimicrobial and antifungal selection, septic shock, cardiogenic shock, neurogenic shock and neuro/neurosurgical emergencies, burns, sedation.
- PHAR:8721 Leadership and Political Advocacy** arr.
Contemporary issues in pharmacy; role of leadership and advocacy in shaping profession; becoming effective advocates within political and policy making process; development of advocacy and leadership skills essential to improve self, profession, and community. Requirements: P1 or P2 standing.
- PHAR:8722 Current Topics in Health Policy** 2 s.h.
Legislative process and broad range of current issues in health policy; general- and pharmacy-specific health policy topics at state and federal levels. Requirements: P1, P2, P3, or graduate standing.
- PHAR:8724 Health System Pharmacy Practice Management** 2 s.h.
Organizational structure of pharmacy departments in hospitals and health care systems; models for delivery of pharmaceutical care; pharmacy's role in drug-policy decision making; provision of drug information; clinical and distributive pharmacy services; control of pharmacy and pharmacy costs; use of information technology and automation for service delivery; supervisory management; quality improvement. Requirements: P3 standing.
- PHAR:8725 Career Pathways in Pharmacy** 1 s.h.
Career preparation through writing, speaking, reading, and listening; writing résumés, curricula vitae, cover letters; interviewing techniques; electronic portfolios; web-based career information; guest speakers from pharmacy associations, major chains; workshop approach. Requirements: P2 or P3 standing.
- PHAR:8790 Sustainable Clinical Pharmacy Services: Leadership, Management, and Implementation** 2 s.h.
Practical knowledge and understanding of how to implement and sustain clinical pharmacy services in a variety of practice settings; how to identify outcomes to evaluate the success of ongoing services; students explore the perspective of leadership and management as it pertains to clinical pharmacy services.

- PHAR:8793 Introduction to Global Health Studies 1 s.h.**
Overview of topics pertaining to international health and cultural diversity in relation to pharmacy and global health; preparation for student pharmacists to become health care practitioners who optimize the health of patients and society; inspires students to advance the profession by fostering collaboration, global and public health leadership, professionalism and civic engagement; introduction and discussion of important topics in global health, focusing specifically on care of the underserved in a global context.
- PHAR:8794 Emergency Medicine and Toxicology 2 s.h.**
Pharmacology in the world of emergency medicine and toxicology; students learn through lecture, case discussion, class participation, and evaluation of evidence-based medicine literature in emergency medicine and toxicology.
- PHAR:8795 Foundations of Palliative Care 2 s.h.**
Introduction to palliative care as a public health issue; exploration of the principles and practice of palliative care including interdisciplinary care of the whole person and family, communication, and self care.
- PHAR:8796 Introduction to Travel Medicine 1 s.h.**
Overview of services provided to travelers to prevent and management conditions that may arise prior to, during, and after international travel; students learn about topics pertaining to each of these areas.
- PHAR:8797 Ethics and Spirituality in Health Care 3 s.h.**
Case-based examination of ethical issues in caring for patients with serious illness; exploration of suffering, spirituality, death, and dying. Requirements: P2 or P3 standing.
- PHAR:8798 Continuing Professional Development in Palliative Care 1 s.h.**
Self-directed learning and development in palliative care; creation and implementation of a professional development plan including activities in service, scholarship and education, leadership and advocacy, and self-care and personal resilience.
- PHAR:8799 Active Residency Preparation 2 s.h.**
Students develop the best understanding of what a residency is, what programs exist, the usual qualifications for placement, and the necessary pathway and components of residency attainment; hands-on experience with preparation process; for pharmacy students interested in pursuing residency training following graduation. Requirements: P3 standing.
- PHAR:8811 New Drugs for New Therapies: Introduction to Drug Discovery, Development, and Registration 1-2 s.h.**
From "magic bullets" to "personalized medicine," the quest for new drugs to treat disease involves serendipity, science, and business success; through lectures, presentations, readings, and discussion, students will learn how potential new drug therapies are identified and what happens between finding a drug that seems to work and the launch of a commercial drug product.
- PHAR:9401 Ambulatory Care Rotation 6 s.h.**
Clinical experience in providing pharmaceutical care in outpatient clinic settings. Requirements: P4 standing.
- PHAR:9402 Elective Ambulatory Care Rotation 6 s.h.**
Clinical experience providing pharmaceutical care in specialty outpatient settings. Requirements: P4 standing.
- PHAR:9403 Elective Nuclear Pharmacy Rotation 6 s.h.**
Practical experience in the handling and clinical use of radiopharmaceuticals. Requirements: P4 standing.
- PHAR:9404 Community Clinical Rotation 6 s.h.**
Clinical experience in the community setting; emphasis on delivery of pharmaceutical care. Requirements: P4 standing.
- PHAR:9405 Elective Hospice and Palliative Care Rotation 6 s.h.**
Clinical experience providing pharmacotherapy for end-of-life care. Requirements: P4 standing.
- PHAR:9406 Elective: Drug Information Rotation 6 s.h.**
Practice experience applying drug information knowledge to service and research projects. Requirements: P4 standing.
- PHAR:9407 Elective Family Medicine Rotation 6 s.h.**
Clinical practice experience applying primary care therapeutics in family medicine practice settings. Requirements: P4 standing.
- PHAR:9408 Elective Hematology/Oncology Rotation 6 s.h.**
Drug therapy management of oncology patients and patients with hematologic malignancies, aplastic anemia, sickle cell disease, hemophilia. Requirements: P4 standing.
- PHAR:9409 Elective Home Health Care Rotation 6 s.h.**
Clinical experience in the team approach to health care delivery, including total parenteral nutrition, chemotherapy, intravenous antibiotics, lab analysis, hospice care, and pain management. Requirements: P4 standing.
- PHAR:9410 Hospital Pharmacy Rotation 6 s.h.**
Instruction and practical experience in various components of hospital pharmacy; emphasis on hospital organization, inpatient and outpatient services, IV admixtures, unit dose, and clinical services. Requirements: P4 standing.
- PHAR:9411 Elective Long Term Care Rotation 6 s.h.**
Practice in consulting and providing services to varied long-term patient care environments. Requirements: P4 standing.
- PHAR:9412 Elective Managed Care Rotation 6 s.h.**
Practice experience in providing pharmaceutical care or pharmacy-related services in a managed care organization. Requirements: P4 standing.
- PHAR:9413 Acute Care Medicine Rotation 6 s.h.**
Clinical experience applying therapeutic skills for the pharmacotherapeutic management of patients on general medicine or specialty inpatient areas. Requirements: P4 standing.
- PHAR:9415 Elective: Pediatrics Rotation 6 s.h.**
Clinical experience in drug therapy management of general and specialty pediatric patients. Requirements: P4 standing.
- PHAR:9416 Elective: Pharmacy Rotation 6 s.h.**
Selected practice experiences in various pharmacy practice settings. Requirements: P4 standing.
- PHAR:9417 Elective Psychiatry Rotation 6 s.h.**
Clinical experience in the rational use of drugs in psychiatric disorders. Requirements: P4 standing.
- PHAR:9418 Elective Research Rotation 6 s.h.**
Practice experience in basic pharmaceutical or clinical research; proposal, study design, data collection and analysis, presentation of results. Requirements: P4 standing.
- PHAR:9419 Elective: Surgery Rotation 6 s.h.**
Clinical experience in drug therapy management on a surgery unit. Requirements: P4 standing.

- PHAR:9420 Elective Pharmacy Practice Underserved Population Rotation 6 s.h.**
Opportunity to learn the best practices for pharmaceutical management; approaches to enhance access to and appropriate use of medicines in underserved and resource-limited environments. Requirements: P4 standing.
- PHAR:9421 Elective Community Management Rotation 6 s.h.**
Practice exposure to community pharmacy operations and management at the store, district, or corporate level. Requirements: P4 standing.
- PHAR:9422 Elective: Compounding/Complementary Alternative Medicine Rotation 6 s.h.**
Clinical work in a community setting with focus on team approach; experience developing extemporaneous compounds to optimize patient care and/or integrating traditional and nontraditional medicine. Requirements: P4 standing.
- PHAR:9423 Elective: Critical Care Medicine Rotation 6 s.h.**
Practice experience providing pharmaceutical services to intensive care unit patients. Requirements: P4 standing.
- PHAR:9424 Elective Emergency Medicine Rotation 6 s.h.**
Clinical experience providing pharmaceutical care for patients treated in the emergency department. Requirements: P4 standing.
- PHAR:9425 Elective Hospital Management Rotation 6 s.h.**
Practice experience in hospital pharmacy operations and management. Requirements: P4 standing.
- PHAR:9426 Elective Infectious Disease Rotation 6 s.h.**
Clinical experience providing pharmacotherapeutic management of patients receiving antimicrobial medications. Requirements: P4 standing.
- PHAR:9427 Elective Medication Use Evaluation Rotation 6 s.h.**
Practical experience in drug use evaluation to improve patient outcomes. Requirements: P4 standing.
- PHAR:9428 Elective Pharmacy Industry Rotation 6 s.h.**
Practice experience in an area of the pharmaceutical or related industries. Requirements: P4 standing.
- PHAR:9429 Elective: Pharmacy Regulatory Rotation 6 s.h.**
Practice experience with a pharmacy regulatory body. Requirements: P4 standing.
- PHAR:9430 Elective: Professional Association Rotation 6 s.h.**
Practice experience in professional association management environment at the state or national level. Requirements: P4 standing.
- PHAR:9431 Elective: Veterinary Pharmacy Rotation 6 s.h.**
Practice experience in managing drug therapy for animals. Requirements: P4 standing.
- PHAR:9432 Elective Community Rotation 6 s.h.**
Community pharmacy experience emphasizing patient-centered care. Requirements: P4 standing.
- PHAR:9433 Elective Academic Rotation 6 s.h.**
Practice experience delivering pharmacy education with a College of Pharmacy faculty member. Requirements: P4 standing.
- PHAR:9434 Elective International Pharmacy Non-Patient Care Rotation 6 s.h.**
Practice experiences in pharmacy practice outside the United States with a focus on research, health care policy, and/or pharmacy education. Requirements: P4 standing.
- PHAR:9435 Administrative Bye Rotation 6 s.h.**
- PHAR:9436 Elective Transitions of Care Rotation 6 s.h.**
Practice experience consulting and providing services to patients transitioning through different patient care environments.
- PHAR:9437 Elective Informatics Rotation 6 s.h.**
Practice experience in informatics in health care setting.
- PHAR:9438 Elective International Pharmacy Patient Care Rotation 6 s.h.**
Practice experiences in pharmacy practice outside the United States with a patient care focus.
- PHAR:9440 Elective Virtual Rotation 6 s.h.**
Experience with disease state management and board preparation; students examine medical literature to answer drug information questions, reflect on current issues facing the medical community, and identify potential solutions to problems for individual patients and populations; activities are intended to guide students toward professional competency. Requirements: P4 standing.
- PHAR:9441 Elective Neurology Rotation 6 s.h.**
Clinical experience in pharmacotherapeutic and pathophysiologic considerations of neurological disorders. Requirements: P4 standing.