

Pharmacy

Graduation requirements and regulations for every academic program are provided in this catalog; however, this catalog is for informational purposes only and does not constitute a contract. Degree and program requirements and course descriptions are subject to change.

In most cases, you will use the catalog of the year you entered KU (see your advisor (<http://www.advising.ku.edu/>) for details). Other years' catalogs (<https://catalog.ku.edu/archives/>)»

Medicinal Chemistry (<https://catalog.ku.edu/pharmacy/medicinal-chemistry/>) Master of Science in Medicinal Chemistry (<https://catalog.ku.edu/pharmacy/medicinal-chemistry/ms/>)
Doctor of Philosophy in Medicinal Chemistry (<https://catalog.ku.edu/pharmacy/medicinal-chemistry/phd/>)

Pharmaceutical Chemistry (<https://catalog.ku.edu/pharmacy/pharmaceutical-chemistry/>) Master of Science in Pharmaceutical Chemistry (<https://catalog.ku.edu/pharmacy/pharmaceutical-chemistry/ms/>)
Doctor of Philosophy in Pharmaceutical Chemistry (<https://catalog.ku.edu/pharmacy/pharmaceutical-chemistry/phd/>)

Pharmacology and Toxicology (<https://catalog.ku.edu/pharmacy/pharmacology-toxicology/>) Master of Science in Neurosciences (<https://catalog.ku.edu/pharmacy/pharmacology-toxicology/ms-neurosciences/>)
Master of Science in Pharmacology and Toxicology (<https://catalog.ku.edu/pharmacy/pharmacology-toxicology/ms/>)
Doctor of Philosophy in Neurosciences (<https://catalog.ku.edu/pharmacy/pharmacology-toxicology/phd-neurosciences/>)
Doctor of Philosophy in Pharmacology and Toxicology (<https://catalog.ku.edu/pharmacy/pharmacology-toxicology/phd/>)

Pharmacy Practice (<https://catalog.ku.edu/pharmacy/pharmacy-practice/>) Bachelor of Science in Pharmaceutical Studies (<https://catalog.ku.edu/pharmacy/pharmacy-practice/bs-pharmaceutical-studies/>)

Doctor of Pharmacy (<https://catalog.ku.edu/pharmacy/pharmacy-practice/doctor-pharmacy/>)
PharmD Research Certificate (<https://catalog.ku.edu/pharmacy/pharmacy-practice/pharmd-research-certificate-program/>)
Master of Science in Pharmacy Practice (<https://catalog.ku.edu/pharmacy/pharmacy-practice/ms/>)

The School of Pharmacy

Since its founding in 1885, the University of Kansas School of Pharmacy (<http://pharmacy.ku.edu/>) has been a leader in pharmacy education. Since 1996, the school has only offered the Doctor of Pharmacy degree as the entry-level practice degree. The curriculum gives the student the knowledge, skills, and ability required of the pharmacy practitioner; it is comprehensive and produces a highly competent general practitioner.

Approximately 65 full-time faculty members teach in the undergraduate professional Doctor of Pharmacy and graduate programs. Three departments (Pharmacology and Toxicology, Medicinal Chemistry, and Pharmaceutical Chemistry) offer Master of Science and Doctor of Philosophy degrees. The Department of Pharmacy Practice offers the master's degree.

Both the undergraduate and graduate divisions have outstanding national and international reputations based on the excellence and productivity of the faculty. KU is consistently ranked in the top 5 among colleges/schools of pharmacy that receive National Institutes of Health research funding. KU's School of Pharmacy was awarded more than \$11 million in research grants and contracts from the NIH in fiscal year 2017.

The School of Pharmacy is fully accredited by the Accreditation Council for Pharmacy Education (<https://www.acpe-accredit.org/>), 190 S. LaSalle St, Suite 2850, Chicago, IL 60603-4810, (312) 664-3575, info@acpe-accredit.org, the official accrediting body for American schools of pharmacy.

Professional Program

The School of Pharmacy offers a 6-year Doctor of Pharmacy (<https://catalog.ku.edu/pharmacy/pharmacy-practice/doctor-pharmacy/>) program. The 2-year pre-pharmacy portion of the program may be taken at any accredited 2- or 4-year college.

After acceptance into the School of Pharmacy students complete the first 2 years of the Doctor of Pharmacy professional degree program (3rd and 4th year of college) are then awarded a Bachelor of Science in Pharmaceutical Studies (BSPS). Students must then go on to complete the remaining 5th and 6th professional years to be awarded the Doctor of Pharmacy (Pharm.D.) degree, which makes them eligible to sit for licensure examinations (NAPLEX and MPJE). These degree programs are available to students on both the Lawrence and Wichita campuses.

University Honors Program

The school encourages qualified students entering KU as freshman to participate in the University Honors Program (<http://www.honors.ku.edu/>).

Graduate Programs

The School of Pharmacy offers graduate programs through the departments of

- Medicinal Chemistry (<https://catalog.ku.edu/pharmacy/medicinal-chemistry/>),
- Pharmaceutical Chemistry (<https://catalog.ku.edu/pharmacy/pharmaceutical-chemistry/>),
- Pharmacology and Toxicology (<https://catalog.ku.edu/pharmacy/pharmacology-toxicology/>), and
- Pharmacy Practice (<https://catalog.ku.edu/pharmacy/pharmacy-practice/>).

The Department of Pharmacy Practice offers the Master of Science degree. The other 3 departments offer both the M.S. and the Ph.D. with majors in their respective disciplines. Programs in Neurosciences (<https://catalog.ku.edu/pharmacy/pharmacology-toxicology/>) are offered in cooperation with KU Medical Center.

Requirements for admission and baccalaureate preparation vary with each department and are discussed separately. Address inquiries and correspondence about graduate studies to the program or department of interest.

Undergraduate Scholarships and Financial Aid

Financial Aid and Scholarships (<https://financialaid.ku.edu>), located at the KU Visitor Center at 1502 Iowa St, Lawrence, KS 66045-7518, 785-864-4700, financialaid@ku.edu, administers grants, loans, and other need-based financial aid. In recent years, about \$29 million has been processed annually through the office, including about \$2 million annually in short-term loans. Prospective students should contact Financial Aid and Scholarships. Some financial aid programs have application deadlines as early as **January 15**. The earlier an application is received and the student's file is completed, the better the chance of obtaining financial aid.

For information about scholarships from KU and various outside agencies based on academic merit, diversity, major, and residence, visit Scholarship Information for KU Students (<https://financialaid.ku.edu/understand-aid/scholarships/>).

School of Pharmacy Financial Aid

The School of Pharmacy, in cooperation with Financial Aid and Scholarships (<https://financialaid.ku.edu>), offers financial assistance to pharmacy students. Applications are received in the dean's office according to an announced schedule each year. Awards are based on merit and need. Assistance is available for both entering and continuing students.

Graduate Fellowships and Assistantships

For information about graduate assistantships, contact the School of Pharmacy (<http://pharmacy.ku.edu>). Visit the Graduate Studies website for information about funding opportunities (<http://graduate.ku.edu/funding/>) for graduate students at KU. Financial Aid and Scholarships (<https://financialaid.ku.edu>) administers grants, loans, and need-based financial aid.

Undergraduate University Regulations

For information about university regulations, see Regulations (<https://catalog.ku.edu/regulations/>) or visit the University of Kansas Policy Library (<http://www.policy.ku.edu/>).

Academic Misconduct

Instructors detecting academic misconduct must act in accordance with the School of Pharmacy (<http://policy.ku.edu/pharmacy/academic-professional-scholarly-conduct/>) and Faculty Senate Rules and Regulations (<http://policy.ku.edu/governance/USRR/>).

Students experiencing difficulties or problems with a particular course or having complaints or grievances about a particular instructor are urged to discuss the problem in a timely fashion with the instructor. If the student feels awkward or uncomfortable doing this, he or she should see the chair of the instructor's department, or if necessary, an associate dean. The

chair or dean brings the matter to the instructor's attention, preserving the student's anonymity, if so requested.

Credit/No Credit

A Credit/No Credit option is available to all degree-seeking undergraduates. You may enroll in one pre-pharmacy course a semester under the option, if the course is not in your major or minor. For more information, visit the KU Policy Library (<http://www.policy.ku.edu/>). All professional coursework is graded. **Warning:** Undesirable consequences regarding admission may result from exercising the option. Some schools, scholarship committees, and honorary societies do not accept this grading system and convert grades of No Credit to F when computing grade-point averages.

Exemptions and Petitions

A student may gain an exemption or academic credit from introductory pre-pharmacy courses by successfully completing the Advanced Placement or College Level Examination Program examinations or by other recognized means. A total of 208 credit hours of college-level course work is still required for the PharmD degree. In meritorious cases, the department offering a specific course may waive course prerequisites. Students whose educational goals would be better served by courses other than those prescribed in the normal curriculum may petition the admissions and/or curriculum committee(s) for permission to make appropriate course substitutions.

Graduation with Distinction and Highest Distinction

Students who rank in the upper 10 percent of their graduating class graduate with distinction. The upper third of those awarded distinction graduate with highest distinction. Grade-point averages are determined on the basis of credit hours taken while enrolled in the School of Pharmacy. The list is compiled each spring and includes July, December, and May graduates.

Health Insurance and Immunizations

The School of Pharmacy requires students to provide proof of health insurance and professional insurance coverage and immunizations for MMR, hepatitis B, varicella, and tetanus, and a current TB skin test.

Honor Roll

Students with grade-point averages of 3.5 who have completed at least 12 professional hours are recognized on the honor roll or dean's list in fall and spring. An Honor Roll notation appears on the transcript.

Maximum Community College Credit Allowed

The School of Pharmacy allows a maximum of 68 credit hours from any accredited college or university toward completion of the PharmD degree prerequisites. All professional coursework must be completed at a college or school of pharmacy that is accredited by ACPE. To graduate from KU School of Pharmacy, all P3 and P4 coursework and rotations (APPEs) must be completed at KU.

Prerequisites and Corequisites

In meritorious cases, course prerequisites may be waived by the department offering the course. Waiver is not granted if the prerequisite course was taken and failed.

Probation

Probation

A student will be placed on academic probation if they:

1. fail to attain a 2.5 grade point average of professional coursework in any semester, or whose overall professional course grade-point average falls below 2.5.
 - a. A student falling below the minimum grade point average of 2.5 will be required to develop and submit an individualized remediation plan to their Academic Faculty Advisor and the Chair of the Academic Standings committee.
2. fail an introductory or advanced pharmacy practice experience.
 - a. A student failing either an IPPE or APPE will be required to develop an individualized remediation plan with the Assistant Dean for Experiential Education and the Associate Deans for Administration and Academic Affairs.
3. fails two or more milestone exams within the six-semester pharmacy skills laboratory curriculum.
4. fails to comply with programmatic requirements in a timely manner (see the pharmacy student handbook (<https://policy.ku.edu/pharmacy/pharmacy-student-handbook/>)).

Suspension

A student who fails or does not make timely progress in a course or courses while a student in the School of Pharmacy may be placed on suspension. Additionally, a student who fails to comply with the School conduct policy, or academic and/or programmatic requirements may be placed on suspension.

Dismissal

Students will be dismissed from school if they:

1. fail to attain a 2.5 grade-point-average in all courses or in professional courses for any semester while on probation.
2. receive a grade of "F" in 40 percent or more of the credit hours taken during any semester (including semesters in which they are enrolled in only one course).
3. fail an individual course twice.
4. fail two advanced pharmacy practice experiences (APPEs).
5. they fail a milestone exam within the six-semester pharmacy skills laboratory curriculum while on probation as a result of prior milestone failure or academic poor performance (i.e. professional GPA <2.5)
6. are placed on probation or suspended for a second academic semester for failure to comply with programmatic requirements.

Petitions

Students dismissed for poor scholarship may file a written petition with the academic standing committee for reinstatement. The committee's decision is final. The committee normally takes one of the following actions:

1. The student is allowed to enroll, often with specific recommendations regarding strategies for restoring good academic standing.
2. The committee may deny the petition.

Courses Taken Outside the School

Students on probation or in nondegree-student status may take courses outside the School of Pharmacy, or at other institutions, to improve the grade-point average. Prior approval is required, and in general, only courses that count toward graduation are honored. All professional coursework must be completed at a college or school of pharmacy that is accredited by ACPE.

Return to Good Standing

Students will return to good standing when the overall pharmacy grade point average reaches 2.5. Students are required to be in good standing (i.e. GPA of 2.5 or higher) to be eligible to enroll and participate in advanced pharmacy practice experiences. If a student who was placed on academic probation due to milestone exam failure passes all the milestone exams during the subsequent semester they will be removed from probation (only if their professional GPA is also at or above 2.5).

1. Students with professional GPAs at or above 2.5 who are on academic probation due to milestone failure(s) at the end of their P3 spring will be required to complete a remediation rotation with a faculty member, preferably in a practice setting similar to the milestone failure. These students will need to pass the remediation rotation in order to start in their required 9 APPE rotations.
2. Courses taken outside the School: Only courses completed within an ACPE accredited institution may be used to increase a student's professional GPA. Authorization to complete or use non-KU School of Pharmacy professional coursework requires prior Curriculum Committee approval. Credit for coursework completed as part of a dual degree (e.g. MBA, MSCR, etc), academic minors (e.g. business, etc), or other coursework outside the School of Pharmacy are not included in GPA calculations to determine a student's academic standing or eligibility for progression to the P4 year.

Required Work in Residence

To be eligible for the Doctor of Pharmacy degree, all P3 and P4 coursework and rotations (APPEs) must be completed in residence at the KU School of Pharmacy

Terminal-Year Courses

A student cannot enroll in the principal terminal-year pharmacy practice experiential rotations unless he or she has a grade-point average in professional courses of at least 2.5 and has completed all didactic course work required for the degree and expected programmatic requirements as outlined in the student handbook.

Graduate University Regulations

For information about university regulations, see Regulations (<https://catalog.ku.edu/regulations/>) or visit the University of Kansas Policy Library (<http://www.policy.ku.edu/>).

Academic Forgiveness

The school does not participate in academic forgiveness.

Academic Misconduct

Students experiencing difficulties or problems with a particular course or having complaints or grievances about a particular instructor are urged to discuss the problem in a timely fashion with the instructor. If the student feels awkward or uncomfortable doing this, he or she should see the chair of the instructor's department, or if necessary, the dean. The chair or dean brings the matter to the instructor's attention, preserving the student's anonymity, if so requested.

Instructors detecting academic misconduct must act in accordance with the School of Pharmacy (<http://policy.ku.edu/pharmacy/academic-professional-scholarly-conduct/>) and Faculty Senate Rules and Regulations (<http://www.policy.ku.edu/>).

Credit/No Credit

The Credit/No Credit option is not authorized for graduate students' enrollments, including, but not limited to, courses taken to fulfill the research skills requirements, undergraduate deficiencies, etc.

Graduation with Distinction and Highest Distinction

Students who rank in the upper 10 percent of their graduating class graduate with distinction. The upper third of those awarded distinction graduate with highest distinction. Grade-point averages are determined on the basis of credit hours taken while enrolled in the School of Pharmacy. The list is compiled each spring and includes July, December, and May graduates.

Health Insurance and Immunizations

The School of Pharmacy requires students to provide proof of health insurance and professional insurance coverage and immunizations for MMR, hepatitis B, varicella, and tetanus, and a current TB skin test.

Requirements to Practice Pharmacy in Kansas

A license is required to practice pharmacy. State boards of pharmacy grant licenses to students who successfully pass board examinations. In all states, eligibility to take board examinations requires graduation from an accredited school of pharmacy and completion of required experiential training. The Kansas State Board of Pharmacy (<https://pharmacy.ks.gov/>) requires graduates of schools of pharmacy to indicate any current, pending, or previous convictions, fines, violations, or disciplinary action that may affect their eligibility to take the licensing examination. Pharmacists generally may transfer their licenses from a state in which they completed the entire examination to another state, provided the 2 states had similar practical experience requirements at the time the pharmacist was licensed by examination. Most pharmacists find it useful to maintain a license in the state where they were licensed by examination. By doing so, they can preserve their eligibility to transfer to another state.

Pharmacists in Kansas must renew their licenses biennially by paying the required fee and providing proof that they have completed the required 30 clock hours of continuing education.

The Kansas Board of Pharmacy requires completion of an appropriate degree from an accredited school of pharmacy plus 1,500 hours of practical experience in pharmacy. At the conclusion of the program, students are certified to the Kansas State Board of Pharmacy as having

completed the entire externship requirement (1,500 hours) and are therefore eligible to take the Kansas licensure examination. Students must register as interns with the board at matriculation in the School of Pharmacy. Students desiring to compile an official record of pharmacy experience obtained on their own initiative may do so by submitting this information to the Kansas State Board of Pharmacy. Practical experience above and beyond the 1,500 required hours may be gained by working as a licensed pharmacy student intern in Kansas, then transferring the hours to another state.

Medicinal Chemistry Courses

MDCM 601. Medicinal Biochemistry I. 3 Credits.

A study of the biochemical principles of macromolecular structure and function, molecular communication, and the metabolism of nutrients and xenobiotics as applied to problems of medicinal and pharmacological significance.

MDCM 603. Medicinal Biochemistry II. 3 Credits.

A study of the biochemical principles of macromolecular structure and function, biosynthesis, molecular communication, and the metabolism of nutrients and xenobiotics as applied to problems of medicinal and pharmacological significance. Prerequisite: Students must have first year professional standing in the School of Pharmacy. Students must have successfully completed MDCM 601.

MDCM 606. Phytomedicinal Agents. 1 Credits.

This course will acquaint the pharmacy students with the current status of botanical use in the United States. A basic foundation will be provided so that the pharmacist can properly assess the appropriateness and usefulness of various phytomedicines and combinations in managing certain ailments with regard to efficacy, safety, potential toxicity, and potential herb-drug interactions. Prerequisite: Students must be admitted to the school or division of Pharmacy and have successfully completed MDCM 601 to enroll in this course.

MDCM 608. Medicinal Chemistry of Neurodegenerative Diseases. 1 Credits.

A course designed to acquaint pharmacy students with diseases that affect and deteriorate the central nervous system. Students will learn the (1) pathophysiology of prevalent neurodegenerative disorders, (2) criteria used to diagnose and discriminate the disorder, (3) current treatments available, and (4) new therapeutic strategies (or modalities) being developed and clinically evaluated. Students will familiarize themselves with each disease topic by reading and critically assessing primary scientific literature provided by the instructor(s). Selected manuscripts will provide relevant background on the disorder and detail medicinal chemistry approaches to address its underlying etiology and/or symptomology. Assigned students will lead in class discussions of the reading materials, commenting on topics including, but not limited to, the merits of the research hypothesis, experimental design and protocols, interpretation of results, validity of the conclusions, and prospects for therapeutic translation. Discussions will follow a defined prompt provided by the instructor(s) for each topic. At the conclusion of the course, students will have a working knowledge of the cause, diagnosis, and treatment of pervasive neurodegenerative diseases, and develop skills for comprehending and critiquing scientific literature in the field of medicinal chemistry. Prerequisite: MDCM 625. Consent of Instructor.

MDCM 625. Medicinal Chemistry I: Neuroeffector and Cardiovascular Agents. 4 Credits.

A study, from the molecular viewpoint, of the organic substances used as medicinal agents, including consideration of their origins, chemical properties, structure-activity relationships, metabolism and mechanisms of action; this course emphasizes drugs affecting the cardiovascular

and central nervous systems. Prerequisite: Students must be admitted to the school or division of Pharmacy and have successfully completed MDCM 603 to enroll in this course.

MDCM 626. Medicinal Chemistry II: Homeostatic Agents. 4 Credits.

A continuation of MDCM 625 with special emphasis on anticancer, antiviral, antibacterial, antifungal, antidiabetic, anticholesterol, and steroidal drugs. Prerequisite: Students must have second year professional standing in the School of Pharmacy. Students must have successfully completed MDCM 625.

MDCM 690. Undergraduate Research. 1-5 Credits.

Research in medicinal chemistry. Students will be assigned to a laboratory research problem. Prerequisite: Consent of instructor.

MDCM 692. Problems in Medicinal Chemistry. 1-5 Credits.

This course encompasses original work on a laboratory problem of limited scope, honors reading assignments from medicinal chemistry literature, or in-depth discussions of assigned topics. Prerequisite: Consent of instructor.

MDCM 701. Advanced Medicinal Biochemistry I. 3 Credits.

A study of the principles of macromolecular structure and function, biosignaling, bioenergetics and metabolism, with an emphasis on the relationship between biochemistry and medicine. Prerequisite: Graduate standing or permission of instructor.

MDCM 710. Chemistry of Drug Action I. 4 Credits.

This course provides an overview of topics central to the understanding and practice of contemporary medicinal chemistry. It illustrates the interplay of anatomy and physiology with the organic-, bio- and analytical chemistry of drugs in the body. Topics covered include physiological mechanisms and disease processes; cell structure and function; basic intermediary metabolism; basic principles underlying drug action including the physicochemical properties of drugs and how these affect the interaction of drugs with living systems; chemical and biological manipulation of the absorption, distribution, metabolism and excretion of drugs and prodrugs; kinetics and inhibition of enzymes and transporters; quantitation and molecular modeling of drug binding to targets. Prerequisite: One year of organic chemistry, one semester of biochemistry, and one college-level course in biology.

MDCM 790. Chemistry of Drug Action II. 3 Credits.

A discussion of the principles of contemporary drug design with specific examples chosen from the original literature. This course covers the organic substances used as medicinal agents, including consideration of their origins, chemical properties, structure-activity relationships, metabolism and mechanisms of action. Prerequisite: Graduate standing or completion of MDCM 625 and MDCM 626.

MDCM 798. Master's Literature Seminar in Medicinal Chemistry. 1 Credits.

Literature seminar for graduate students in Spring of their 2nd year. Prerequisite: Graduate students in 2nd year of program.

MDCM 799. Research Seminar in Medicinal Chemistry. 1 Credits.

Reports by research students and discussions of developments in the field not covered in formal courses.

MDCM 801. Issues in Scientific Integrity. 1 Credits.

Lectures and discussion on ethical issues in the conduct of a scientific career, with emphasis on practical topics of special importance in molecular-level research in the chemical, biological, and pharmaceutical sciences. Topics will include the nature of ethics, the scientist in the laboratory, as author, grantee, reviewer, employer/employee, teacher/student, and citizen. Discussions will focus on case histories. This course

is open only to distance education students. Graded on a satisfactory/unsatisfactory basis. (Same as MDCM 801, NURO 801, P&TX 801, PHCH 801 and PHCH 802.)

MDCM 817. Rigor, Reproducibility and Responsible Conduct in Research. 3 Credits.

This class addresses the recognized problems in rigor, reproducibility, and transparency that are plaguing modern science. Students will learn the fundamentals of hypothesis design, avoiding bias, randomization, sampling, and appropriate statistical analyses, reagent validation, among other key topics. This course also introduces principles for being an ethical, responsible, and professional research scientist. Topics include: plagiarism, fabrication and falsification of data, record keeping and data sharing, mentor/mentee and collaborative relationships, among others. The class will include a mixture of lecture, case studies and discussion. (Same as BIOL 817/CHEM 817/PHCH 817.) Prerequisite: Graduate student.

MDCM 860. Principles and Practice of Chemical Biology. 3 Credits.

A survey of topics investigated by chemical biology methods including: transcription and translation, cell signaling, genetic and genomics, biochemical pathways, macromolecular structure, and the biosynthesis of peptides, carbohydrates, natural products, and nucleic acids. Concepts of thermodynamics and kinetics, bioconjugations and bioorthogonal chemistry will also be presented. (Same as BIOL 860, CHEM 860 and PHCH 860.) Prerequisite: Permission of instructor.

MDCM 895. Research in Medicinal Chemistry. 1-12 Credits.

Hours and credit to be arranged.

MDCM 899. Master's Thesis. 1-12 Credits.

Hours and credit to be arranged. Independent investigation of a research problem of limited scope. Prerequisite: Consent of instructor.

MDCM 980. Proposal Preparation. 2 Credits.

Presentation of a literature seminar and writing an original NIH-style research proposal concerning contemporary problems in medicinal chemistry. Prerequisite: Consent of instructor.

MDCM 999. Doctoral Dissertation. 1-12 Credits.

Hours and credit to be arranged. Original chemical research in the synthesis and development of medicinal agents, elucidation of the chemical mechanisms of drug action, drug metabolism, and drug toxicities.

Pharmaceutical Chemistry Courses

PHCH 510. Emerging Trends in Pharmaceutical Chemistry I. 1 Credits.

This elective class will explore emerging areas of research currently impacting the pharmaceutical industry. Potential topics include; biologicals as therapeutics, drug targeting, prodrugs, nanotechnology, biological barriers, gene therapy, transporters, vaccines, intracellular drug trafficking, controlled release drug delivery, cancer therapy, analytical biotechnology and many others. The class will be team taught by PHCH faculty and guest speakers. Graded on a satisfactory/unsatisfactory basis. Prerequisite: Must be accepted to the Pharmacy Program.

PHCH 512. Road Map to the Development and Regulatory Approval of a New Drug. 1 Credits.

This special topics course will cover key steps in developing and bringing a new drug through pharmaceutical development and regulatory approval and into commercial use. Development of both traditional small-molecule chemical drugs and biotechnology-based protein drugs will be discussed. Example topics include: (1) how does a drug candidate move from its discovery at the lab bench into clinical trials? (2) what are the key hurdles

in developing a new medicine that can be produced at large-scale in a manufacturing facility? (3) why are patents and venture capital so important in drug development? Guest lecturers will provide real world perspectives including case studies. This is two-hour class that meets 8 times during the semester. Prerequisite: 1st, 2nd or 3rd professional year standing in the School of Pharmacy.

PHCH 517. Pharmacy Calculations. 2 Credits.

An introduction to the mathematics involved in filling prescriptions and in manufacturing pharmaceuticals. Includes an introduction to standard prescription notation and familiarization with pharmaceutical weights and measures.

PHCH 518. Physical-Chemical Principles of Solution Dosage Forms. 3 Credits.

Physical properties of pharmaceutical solutions and their physiological compatibility will be discussed (intermolecular interactions, energetics, colligative properties, isotonicity, pH, buffers and drug solubility). Kinetics and mechanisms of drug degradation in solution will also be introduced. Prerequisite: Students must have first year professional standing in the School of Pharmacy. Students must have successfully completed PHCH 517.

PHCH 605. Vaccines. 1 Credits.

Vaccines are currently the most powerful therapeutic approach available for infectious disease and promise to become of increasing importance for a wide variety of other pathologies including cancer. This course discusses the immunological basis of vaccinology, types of vaccines currently available and in development and the process by which vaccines are made from the basic research stage through their pharmaceutical development and marketing. Ethical aspects of vaccine use will also be considered. Prerequisite: Students must have first, second or third year professional standing in the School of Pharmacy.

PHCH 625. Pharmacokinetics. 3 Credits.

A discussion of the basic concepts, and some clinical applications, of pharmacokinetics, clearance concepts, extravascular dosing, and the use of pharmacokinetics in dosage regimen design and adjustment. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Students must have successfully completed PHCH 517 and PHCH 518.

PHCH 626. Biopharmaceutics and Drug Delivery. 3 Credits.

A study of biological barriers to drug delivery, conventional dosage forms, and new and future drug delivery strategies. Prerequisite: Students must have second year professional standing in the School of Pharmacy. Students must have successfully completed PHCH 517, PHCH 518, and PHCH 625.

PHCH 667. Introduction to Clinical Chemistry. 2 Credits.

A lecture-discussion course concerned with identification of the contents of physiological fluids, changes in physiological fluid content induced by disease and drugs, and therapeutic drug monitoring; case studies are presented. Prerequisite: Must be accepted to the Pharmacy Program.

PHCH 690. Undergraduate Research in Pharmaceutical Chemistry. 1-5 Credits.

Student will be assigned a suitable research project in the area of pharmaceutical analysis or pharmaceutics. Prerequisite: Consent of instructor.

PHCH 693. Clinical Pharmacokinetics. 2 Credits.

This course presents discussions on physiological and disease state variables in pharmacokinetics for selected drugs and drug classes, and instructs students in the use of physiological and disease state pharmacokinetic information to develop individualized therapeutic regimens. Prerequisite: Students must be admitted to the school of

Pharmacy to enroll in this course. Students must have successfully completed PHCH 625 and PHCH 626.

PHCH 694. Problems in Pharmaceutical Chemistry. 1-5 Credits.

A student will be assigned a suitable research project in an area of pharmaceutical analysis or pharmaceutics. This course is offered regularly by the Department of Pharmaceutical Chemistry to meet the special needs of selected students, usually for one of the following two situations: (1) This course may be taken when a student has a special interest in a problem or area of limited scope and desires to pursue that study in depth under supervision of a member of the faculty. (2) This course is sometimes used as a remedial class to provide a mechanism of intensive review and study in an area of weakness. Prerequisite: Consent of instructor.

PHCH 700. Experimental Methods in Pharmaceutical Chemistry. 1-5 Credits.

Discussions, lectures, and laboratory work designed to acquaint and provide hands on experiences to advanced undergraduate and graduate students with experimental design, methods, and approaches relevant to modern research in pharmaceutical chemistry. Prerequisite: Consent of instructor.

PHCH 705. Writing and Communicating Science for Graduate Students. 3 Credits.

Communicating research proposals and experimental findings is a critical skill for scientists. Successful communication depends on clarity of thought and careful use of language. This course will use class discussions with examples and homework assignments to help prepare the graduate student to successfully communicate in both academia and industry settings. Graded on a satisfactory/unsatisfactory basis. Prerequisite: Graduate standing in PHCH or consent of the instructor.

PHCH 706. Writing and Communicating Science for Graduate Students. 3 Credits.

Communicating research proposals and experimental findings is a critical skill for scientists. Successful communication depends on clarity of thought and careful use of language. This course will use class discussions with examples and homework assignments to help prepare the graduate student to successfully communicate in both academia and industry settings. Graded on a satisfactory/unsatisfactory basis. Prerequisite: This course is only open to distance education students.

PHCH 712. Road Map to the Development and Regulatory Approval of a New Drug. 1 Credits.

This special topics course will cover key steps in developing and bringing a new drug through pharmaceutical development and regulatory approval and into commercial use. Development of both traditional small-molecule chemical drugs and biotechnology-based protein drugs will be discussed. Example topics include: (1) how does a drug candidate move from its discovery at the lab bench into clinical trials? (2) what are the key hurdles in developing a new medicine that can be produced at large-scale in a manufacturing facility? (3) why are patents and venture capital so important in drug development? Guest lecturers will provide real world perspectives including case studies. This is two-hour class that meets 8 times during the semester. Prerequisite: Graduate standing in Pharmaceutical Chemistry or a trainee of the NIH Biotech Training Grant.

PHCH 715. Drug Delivery. 3 Credits.

The course will survey the latest technology for delivering pharmaceuticals and biologicals to reduce side effects and enhance drug efficacy. The course will survey the latest research in this area and examine more classical delivery methods. A qualitative and quantitative understanding of drug delivery practice and theory is the goal. Prerequisite: Master's or PhD candidate in Engineering, Chemistry,

Medicinal Chemistry, or Pharmaceutical Chemistry (by appointment for seniors or graduate students in departments not listed).

PHCH 716. Drug Delivery. 3 Credits.

The course will survey the latest technology for delivering pharmaceuticals and biologicals to reduce side effects and enhance drug efficacy. The course will survey the latest research in this area and examine more classical delivery methods. A qualitative and quantitative understanding of drug delivery practice and theory is the goal. Prerequisite: This course is only open to distance education students.

PHCH 717. Drug Delivery. 3 Credits.

The course will survey the latest technology for delivering pharmaceuticals and biologicals to reduce side effects and enhance drug efficacy. The course will survey the latest research in this area and examine more classical delivery methods. A qualitative and quantitative understanding of drug delivery practice and theory is the goal. This course is only open to external non-degree seeking students. Offered in spring semesters. Prerequisite: PHCH 732.

PHCH 718. Physical-Chemical Principles of Solution Dosage Forms. 3 Credits.

Physical properties of pharmaceutical solutions and their physiological compatibility will be discussed (intermolecular interactions, energetics, colligative properties, isotonicity, pH, buffers and drug solubility). Kinetics and mechanisms of drug degradation in solution will also be introduced. Prerequisite: Graduate standing.

PHCH 719. Physical-Chemical Principles of Solution Dosage Forms. 3 Credits.

Physical properties of pharmaceutical solutions and their physiological compatibility will be discussed (intermolecular interactions, energetics, colligative properties, isotonicity, pH, buffers and drug solubility). Kinetics and mechanisms of drug degradation in solution will also be introduced. This course is only open to distance education students. Prerequisite: Graduate standing.

PHCH 721. Physical-Chemical Principles of Solution Dosage Forms. 3 Credits.

Physical properties of pharmaceutical solutions and their physiological compatibility will be discussed (intermolecular interactions, energetics, colligative properties, isotonicity, pH, buffers and drug solubility). Kinetics and mechanisms of drug degradation in solution will also be introduced. This course is only open to external non-degree seeking students. Offered in spring semesters.

PHCH 725. Cellular and Molecular Pharmaceutics. 3 Credits.

The pharmaceutical relevance of fundamental and advanced concepts in cell biology and the molecular interactions responsible for cell and tissue functions, homeostasis in health and disease will be presented. Current analytical methods for examining cells and tissues, and molecular components important in understanding drug and protein biodistribution and metabolism will be discussed. Discussion topics will include the chemical and physical properties of small molecules, proteins, nucleic acids and lipids and their impact on cellular and subcellular structures and ultimately of either adverse or therapeutic benefit. (Same as C&PE 725.) Prerequisite: Graduate standing or consent of instructor.

PHCH 726. Cellular and Molecular Pharmaceutics. 3 Credits.

The pharmaceutical relevance of fundamental and advanced concepts in cell biology and the molecular interactions responsible for cell and tissue functions, homeostasis in health and disease will be presented. Current analytical methods for examining cells and tissues, and molecular components important in understanding drug and protein biodistribution and metabolism will be discussed. Discussion topics will include the chemical and physical properties of small molecules, proteins, nucleic

acids and lipids and their impact on cellular and subcellular structures and ultimately of either adverse or therapeutic benefit. Prerequisite: Graduate standing or consent of instructor.

PHCH 730. Biopharmaceutics and Pharmacokinetics. 3 Credits.

A quantitative treatment of the processes involved with drug absorption, distribution, metabolism, and excretion in living systems.

PHCH 731. Biopharmaceutics and Pharmacokinetics. 3 Credits.

A quantitative treatment of the processes involved with drug absorption, distribution, metabolism, and excretion in living systems. This course open only to distance education students.

PHCH 732. Biopharmaceutics and Pharmacokinetics. 3 Credits.

A quantitative treatment of the processes involved with drug absorption, distribution, metabolism, and excretion in living systems. This course is only open to external non-degree seeking students. Offered in fall semesters.

PHCH 744. Organic Chemistry for Pharmaceutical Scientists. 3 Credits.

A consideration of the structural features and driving forces that control the course of chemical reactions. Topics will include functional group chemistry: electronic structure, acid/base properties: molecular structure and properties (dipole, strain, and steric effects, inductive and resonance effects); dynamics of reactions (the major organic reaction mechanism, kinetics, energy profiles, isotope effects, linear free energy relationships), solvent effects, stereochemistry and conformation, an introduction to orbital symmetry control; basic thermodynamic and kinetic concepts; and an overview of important classes of mechanisms. This course is only open to distance education students. Prerequisite: CHEM 624 and CHEM 626.

PHCH 801. Issues in Scientific Integrity. 1 Credits.

Lectures and discussion on ethical issues in the conduct of a scientific career, with emphasis on practical topics of special importance in molecular-level research in the chemical, biological, and pharmaceutical sciences. Topics will include the nature of ethics, the scientist in the laboratory, as author, grantee, reviewer, employer/employee, teacher/student, and citizen. Discussions will focus on case histories. This course is open only to distance education students. Graded on a satisfactory/unsatisfactory basis. (Same as MDCM 801, NURO 801, P&TX 801 and PHCH 802.)

PHCH 802. Issues in Scientific Integrity. 1 Credits.

Lectures and discussion on ethical issues in the conduct of a scientific career, with emphasis on practical topics of special importance in molecular-level research in the chemical, biological, and pharmaceutical sciences. Topics will include the nature of ethics, the scientist in the laboratory, as author, grantee, reviewer, employer/employee, teacher/student, and citizen. Discussions will focus on case histories. This course is open only to distance education students. Graded on a satisfactory/unsatisfactory basis. (Same as PHCH 801, MDCM 801, NURO 801, and P&TX 801.)

PHCH 816. Careers in the Biomedical Sciences. 1 Credits.

Advanced course examining career options open to PhD scientists in the biomedical sciences, and providing preparation for the different career paths. Extensive student/faculty interaction is emphasized utilizing lectures, class discussion of assigned readings, and oral presentations. Graded on a satisfactory/unsatisfactory basis. (Same as BIOL 816 and CHEM 816.) Prerequisite: Permission of instructor.

PHCH 817. Rigor, Reproducibility and Responsible Conduct in Research. 3 Credits.

This class addresses the recognized problems in rigor, reproducibility, and transparency that are plaguing modern science. Students will learn the fundamentals of hypothesis design, avoiding bias, randomization,

sampling, and appropriate statistical analyses, reagent validation, among other key topics. This course also introduces principles for being an ethical, responsible, and professional research scientist. Topics include: plagiarism, fabrication and falsification of data, record keeping and data sharing, mentor/mentee and collaborative relationships, among others. The class will include a mixture of lecture, case studies and discussion. (Same as BIOL 817/CHEM 817/MDCM 817.) Prerequisite: Graduate student.

PHCH 850. Formulation Design: Solid Dosage Forms. 1 Credits.

This course is designed to provide an understanding of the formulation and stability of small and large drug candidates in the solid state. The first two-thirds of the course will focus on small molecules, with the last third being devoted to proteins. Graded on a satisfactory/fail basis. Prerequisite: Graduate standing in PHCH or consent of the instructor.

PHCH 851. Solid State Stability and Formulation. 2 Credits.

This course is designed to provide an understanding of the formulation and stability of small and large drug candidates in the solid state. The first two-thirds of the course will focus on small molecules, with the last third being devoted to proteins. This course is open only to distance education students. Prerequisite: Graduate standing in Pharmaceutical Chemistry or consent of the instructor.

PHCH 860. Principles and Practice of Chemical Biology. 3 Credits.

A survey of topics investigated by chemical biology methods including: transcription and translation, cell signaling, genetic and genomics, biochemical pathways, macromolecular structure, and the biosynthesis of peptides, carbohydrates, natural products, and nucleic acids. Concepts of thermodynamics and kinetics, bioconjugations and bioorthogonal chemistry will also be presented. (Same as BIOL 860, CHEM 860 and MDCM 860.) Prerequisite: Permission of instructor.

PHCH 862. Physical Chemistry of Solutions, Solids and Surfaces. 3 Credits.

A course on equilibria in aqueous and non-aqueous systems with emphasis on solutions of interest to pharmaceutical technology. Included are association-dissociation equilibria, complexation, protein binding calculation of species concentrations, estimation of solubility and ionization constants. Methods for the determination of chemical potential in solution are presented.

PHCH 863. Physical Chemistry of Solutions, Solids and Surfaces. 3 Credits.

A course on equilibria in aqueous and non-aqueous systems with emphasis on solutions of interest to pharmaceutical technology. Included are association-dissociation equilibria, complexation, protein binding calculation of species concentrations, estimation of solubility and ionization constants. Methods for the determination of chemical potential in solution are presented. This course is open only to distance education students.

PHCH 864. Pharmaceutical Analysis. 4 Credits.

This course is intended to be a comprehensive treatment of contemporary techniques used to validate analytical methods for the determination of drugs in the bulk form, pharmaceutical formulations, biological samples and other relevant media. The emphasis will be on chromatographic techniques reflecting the preeminent position that those techniques occupy in the field of pharmaceutical and biomedical analysis. Prerequisite: Previous or concurrent enrollment in PHCH 684.

PHCH 865. Pharmaceutical Analysis. 4 Credits.

Advanced course on pharmaceutical analysis. This course is only open to distance education students.

PHCH 870. Advanced Pharmaceutical Biotechnology. 4 Credits.

A course designed to emphasize the important facets of recombinant proteins and vaccines as pharmaceutical agents. Basics of protein structure and analysis will be introduced, and methods for production, isolation, and purification of recombinant proteins will be described. Potential chemical and physical degradation processes and strategies for circumventing these difficulties will be discussed. An overview of the development and formulation of vaccines and their immunological basis will be presented. Prerequisite: BIOL 600 or consent of instructor.

PHCH 871. Advanced Pharmaceutical Biotechnology. 4 Credits.

A course designed to emphasize the important facets of recombinant proteins and vaccines as pharmaceutical agents. Basics of protein structure and analysis will be introduced, and methods for production, isolation, and purification of recombinant proteins will be described. Potential chemical and physical degradation processes and strategies for circumventing these difficulties will be discussed. This course is only open to distance education students. An overview of the development and formulation of vaccines and their immunological basis will be presented. Prerequisite: BIOL 600 or consent of instructor.

PHCH 895. Research in Pharmaceutical Chemistry. 1-11 Credits.

Advanced level research in collaboration with a faculty member in pharmaceutical chemistry or related areas. This course is limited to students who are doing research, but not necessarily working toward either a master's or a doctoral degree.

PHCH 898. Master's Thesis. 1-10 Credits.

Master's Thesis. This course is open only to distance education students.

PHCH 899. Master's Thesis. 1-11 Credits.

Graded on a satisfactory/fail basis.

PHCH 920. Chemical Kinetics. 2 Credits.

This course provides the principles of kinetic data analysis as applied to problems in pharmaceutical chemistry. Topics include the setup and solution of rate equations related to chemical reactions; simplifications and approximations in complex equation systems; isotope, solvent and salt rate effects; and diffusion and activation controlled reactions.

PHCH 921. Chemical Kinetics. 2 Credits.

This course provides the principles of kinetic data analysis as applied to problems in pharmaceutical chemistry. Topics include the setup and solution of rate equations related to chemical reactions; simplifications and approximations in complex equation systems; isotope, solvent and salt rate effects; and diffusion and activation controlled reactions. This course is only open to distance education students.

PHCH 972. Mechanisms of Drug Deterioration and Stabilization. 3 Credits.

A course dealing with mechanisms and chemical kinetics of drug deterioration and stabilization.

PHCH 973. Mechanisms of Drug Deterioration and Stabilization. 3 Credits.

A course dealing with mechanisms and chemical kinetics of drug deterioration and stabilization. This course is only open to distance education students.

PHCH 974. Advanced Special Topics in Pharmaceutical Chemistry. 1-3 Credits.

Various topics pertinent to the area of pharmaceutical chemistry will be explored. Graded on a satisfactory/unsatisfactory basis.

PHCH 978. Pharmaceutical Chemistry Seminar. 1 Credits.

A seminar on the chemistry of pharmaceutical systems.

PHCH 998. Doctoral Dissertation in Pharmaceutical Chemistry. 1-11 Credits.

This course is open only to distance education students.

PHCH 999. Doctoral Dissertation in Pharmaceutical Chemistry. 1-11 Credits.

Pharmacology and Toxicology Courses

NURO 799. Neuroscience Seminar Series. 1 Credits.

Presentations of research papers by faculty, post-doctoral research associates, and graduate students. All graduate students in the Neuroscience program participate in this seminar series throughout their period of training. Each student has to present a seminar once every semester. Presentations by students are evaluated by other graduate students and faculty at the end of each seminar. (Same as NEUS 799.) Prerequisite: Graduate standing in the Neuroscience program.

NURO 800. Neuroscience Teaching Principles. 2 Credits.

This course is to be used by graduate students fulfilling the teaching requirements for the Ph.D. in Neuroscience. Students may choose between in-lab or lecture-based instruction for the course. For in-lab, the student will be paired with an underclassman or rotation student and serve as their primary instructor. For lecture-based, the student will function as a discussion leader and lecturer in a limited number of class sessions. For either track, the student will meet with the faculty they are assisting and participate in individual progress meetings and development of research products (in-lab) or preparation of presentation materials and tests (lecture-based). Each student will be evaluated by the faculty mentor and by the students in the lab or class taught. (Same as NEUS 800.) Prerequisite: Graduate standing in Neuroscience.

NURO 801. Issues in Scientific Integrity. 1 Credits.

Lectures and discussion on ethical issues in the conduct of a scientific career, with emphasis on practical topics of special importance in molecular-level research in the chemical, biological, and pharmaceutical sciences. Topics will include the nature of ethics, the scientist in the laboratory, as author, grantee, reviewer, employer/employee, teacher/student, and citizen. Discussions will focus on case histories. This course is open only to distance education students. Graded on a satisfactory/unsatisfactory basis. (Same as MDCM 801, P&TX 801, PHCH 801 and PHCH 802.)

NURO 803. Neuroscience Literature Review I. 1 Credits.

This course is designed for graduate students and will fulfill the first written exam requirement for the Ph.D. in Neuroscience. The student will research and write a six page literature review by choosing a topic provided by the faculty. Prerequisite: Graduate standing in the Neuroscience Program.

NURO 805. Neuroscience Literature Review. 1 Credits.

This course is designed for graduate students and will fulfill the second written exam requirement for the Ph.D. in Neuroscience. The student will research and write a twelve page literature review by choosing a topic provided by the faculty. Prerequisite: Graduate standing in the Neuroscience Program.

NURO 825. Research in Neuroscience. 1-10 Credits.

Original investigations at an advanced level in the areas of neuroscience. The research by each student will be performed in the laboratory of one of the faculty mentors of the graduate program in Neuroscience. Prerequisite: Graduate standing in the Neuroscience program.

NURO 846. Advanced Neuroscience. 4 Credits.

Team-taught, in-depth neuroscience course focusing on normal and diseased brain function at the molecular, cellular and systems levels. Lectures and discussions will emphasize current issues in neuroscience

research. (Same as ANAT 846, PHCL 846, PHSL 846 and NEUS 846.) Prerequisite: Permission of the course director.

NURO 847. Developmental Neurobiology. 2 Credits.

Development of the nervous system from early induction to the development of learning and memory. Topics include: Induction; Cellular Differentiation; Axon Growth and Guidance; Target Selection; Cell Survival and Growth; Synapse Formation; Synapse Elimination; and Development of Behavior. (Same as ANAT 847, PHSL 847, and NEUS 847.) Prerequisite: Advanced Neuroscience (ANAT 846; NURO 846; PHSL 846) or consent of instructor.

NURO 848. Molecular Mechanisms of Neurological Disorders. 3 Credits.

An in-depth coverage of pathogenic mechanisms in neurological diseases; cellular and molecular responses to brain injury and disease, neuroinflammatory diseases (e.g., multiple sclerosis), neurodegenerative diseases (e.g., Alzheimer's, Parkinson's, Huntington's, amyotrophic lateral sclerosis, and prion diseases), neurogenetic diseases (e.g., lysosomal and peroxisomal disorders, Down's syndrome and fragile X), trauma, stroke, and viral diseases (e.g., HIV encephalitis). (Same as ANAT 848, PHCL 848, PHSL 848, and NEUS 848.) Prerequisite: Advanced Neuroscience (ANAT 846, PHCL 846 or PHSL 846) or an equivalent course and consent of instructor.

NURO 899. Neuroscience Master's Thesis. 1-11 Credits.

Hours and credit for this course to be arranged with the mentor. Independent investigation of a research problem in neuroscience, but of limited scope. Prerequisite: Graduate standing in the Neuroscience program and consent of mentor/instructor.

NURO 999. Neuroscience Doctoral Dissertation. 1-11 Credits.

Hours and credit for this course to be arranged with the mentor. Conduct of original investigation in neurosciences. Prerequisite: Graduate standing in the Neuroscience program post-oral comprehensive examination and consent of mentor/instructor.

Pharmacology and Toxicology Courses

P&TX 630. Pharmacology I. 4 Credits.

The pharmacology series covers the mechanisms by which drugs interact with living organisms. An integrative emphasis will be placed on understanding the molecular basis of drug action with respect to modifying the pathophysiology of specific disease states. Topics in P&TX 630 include, general principles of pharmacokinetics and pharmacodynamics, pharmacology of the nervous system, biotechnology drugs, pharmacogenomics, and vitamins. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Students must have successfully completed BIOL 646.

P&TX 631. Pharmacology II. 3 Credits.

The pharmacology series covers the mechanisms by which drugs interact with living organisms. An integrative emphasis will be placed on understanding the molecular basis of drug action with respect to modifying the pathophysiology of specific disease states. Prerequisite: Students must have first year professional standing in the School of Pharmacy. Students must have successfully completed P&TX 630.

P&TX 632. Pharmacology III. 3 Credits.

The pharmacology series covers the mechanisms by which drugs interact with living organisms. An integrative emphasis will be placed on understanding the molecular basis of drug action with respect to modifying the pathophysiology of specific disease states. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Students must have successfully completed P&TX 630 and P&TX 631.

P&TX 633. Pharmacology IV. 3 Credits.

The pharmacology series covers the basic principles of the immunology, inflammation, and targeted drugs used to regulate the immune response. In addition, basic concepts of infectious diseases and their therapeutics are discussed. Prerequisite: Students must have second year professional standing in the School of Pharmacy. Students must have successfully completed P&TX 630, P&TX 631 and P&TX 632.

P&TX 640. Toxicology. 2 Credits.

General principles of toxicology, treatment, and management of accidental poisoning, and current topics of interest. Prerequisite: Students must have third year professional standing in the School of Pharmacy. Students must have successfully completed P&TX 630, P&TX 631, P&TX 632 and P&TX 633.

P&TX 642. Obesity, Diabetes, and Metabolic Syndrome: Current Concepts. 1 Credits.

The objective of this course is to provide students with an opportunity to read, examine, and report on a broad array of topics relevant to diabetes and obesity. Students will be given broad latitude to propose topics of interest to them within the area of diabetes and obesity. The format of the course will be group presentations. Groups of 3 students will identify a topic of interest to them in the field of diabetes and obesity, prepare a 30 min presentation and deliver it to the class for discussion. Prerequisite: Students must be admitted to the school of Pharmacy and have successfully completed P&TX 630 to enroll in this course.

P&TX 643. Current Concepts of Neurodegenerative Disease. 1 Credits.

Neurodegenerative diseases, such as Alzheimer's and Parkinson's diseases, are associated with older age and/or enhanced oxidative stress. The possible causes for the development and progression of these diseases with relation to current research in the field will be discussed. Additionally, a summary of available and suggested future treatments will be given. Prerequisite: Students must be admitted to the school of Pharmacy and have successfully completed P&TX 630 to enroll in this course.

P&TX 645. Neurobiological Basis of Addiction: Physiological, Biochemical, Pharmacological & Treatment Concepts. 1 Credits.

Several addictions will be discussed including addictions to alcohol, cocaine, methamphetamine, gambling, and others as time permits. The physiology, biochemistry, pharmacology and available treatments for these addictions will be reviewed. The role of pharmacotherapies will be discussed, particularly as they relate to the molecular basis of addiction. Behavioral and psychological approaches also will be examined. Prerequisite: Completion of P&TX 632 or special permission from faculty.

P&TX 646. Current Concepts of Psychotropic Medication. 1 Credits.

This course provides information regarding commonly used psychotropic medications, or any drug that affects brain activities associated with mental processes and behavior. This includes, but are not limited to, the categories of antipsychotics, mood stabilizers, anti-anxiety (anxiolytics), antidepressants, and stimulants. The range of topics from basic biology to drug-drug interactions will be explored in the course. Groups of three students will identify a topic of interest to them in the field of psychotropic drugs and affect, mood, or behavior, prepare a 30 min presentation, and deliver it to the class for discussion. Prerequisite: P&TX 630.

P&TX 647. Gut Microbiota in Health and Disease. 1 Credits.

The human gut is home to about 100 trillion microorganisms (bacteria, archaea, viruses, fungi, and protozoa) that form a complex and dynamic ecosystem – the gut microbiota. This course will explore host-gut microbe interactions across the lifespan, the role of the gut microbiota in health (e.g., immune system development, resistance

to opportunistic pathogens, metabolism, gut-brain axis, behavior), the association between a disrupted microbiota (dysbiosis) and numerous diseases (e.g., inflammatory bowel disease, asthma and allergy, obesity, diabetes, cardiovascular and kidney disorders, depression, and neurodegeneration), and the bidirectional interactions between gut microbes and drugs and other chemicals. The profound effects of diet on microbial diversity will be examined in depth. Approaches to maintaining or restoring a healthy gut microbiota will be considered. Prerequisite: Students must have second-year professional standing in the School of Pharmacy.

P&TX 694. Undergraduate Laboratory: Research in Pharmacology and Toxicology. 1-5 Credits.

Original research on a laboratory problem of limited scope. This course cannot count toward pharmacology and toxicology requirements in the School of Pharmacy. Prerequisite: Consent of instructor.

P&TX 698. Library Problems in Pharmacology and Toxicology. 1-5 Credits.

Original library review of a limited special topic in pharmacology and toxicology. The student will write a review in his or her report. This course may count toward pharmacology and toxicology requirements in the School of Pharmacy. Prerequisite: P&TX 635 and consent of instructor.

P&TX 700. Professional Issues in the Biomedical Sciences. 2 Credits.

A course designed to assist doctoral students in the biomedical sciences in their professional development by providing presentations, discussions, and practical experiences related to career planning. Topics include diverse career opportunities and expectations of each, preparation of vitae/resumes and other elements of a successful job search, writing scientific papers and dealing with editors, developing programmatic research programs, balancing professional obligations, advancing through promotions, and related topics. Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

P&TX 705. Current Concepts in Biochemical Pharmacology and Toxicology. 3 Credits.

A detailed study of the foundational concepts and leading-edge discoveries in biochemistry and molecular biology that underlie the actions and effects of drugs and toxicants with particular relevance to human disease and new therapeutic strategies. The interconnectedness and integration of seemingly disparate pathways and regulatory mechanisms will be emphasized. The technologies and experimental approaches used in biochemical pharmacology and toxicology will be illustrated. Topics may vary from year to year depending on recent advances in the field. The course will involve a combination of lectures and discussions with an emphasis on critically reading and analyzing primary research papers. Students will be evaluated on the basis of oral presentations and take-home problem sets. Prerequisite: Graduate standing in Pharmacology and Toxicology Program. Two semesters of undergraduate biochemistry with molecular biology.

P&TX 730. Advanced Pharmacology I - CNS and ANS. 2 Credits.

A detailed study of the fundamentals of autonomic nervous system, central nervous system, and their pharmacology. Prerequisite: Permission of the course director.

P&TX 731. Advanced Pharmacology II - Cardiovascular and Renal System. 2 Credits.

A detailed study of the fundamentals of cardiovascular system, renal system and their pharmacology. Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

P&TX 732. Advanced Pharmacology III - Immunology and Inflammatory Diseases. 2 Credits.

A detailed study of the fundamentals of inflammation, treatment for infectious disease and gastrointestinal pharmacology. Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

P&TX 733. Advanced Pharmacology IV - Endocrinology. 2 Credits.

A detailed study of the fundamentals of endocrinology and associated pharmacology. Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

P&TX 742. Experimental Pharmacology. 3 Credits.

Experimental approaches to understanding mechanism of drug action. Use of drugs as tools to understand functioning of biological systems will also be stressed. The focus is on the different types of receptor systems and signaling pathways. Topics will include: pharmacokinetics, pharmacodynamics, G-protein linked receptors, ion channels, nuclear receptors and kinase signaling cascades. Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

P&TX 747. Molecular Toxicology. 2 Credits.

A detailed study of the fundamentals of the experimental methods used in a modern toxicology laboratory. Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

P&TX 750. Pharmacology I- Introduction to Pharmacology and Biotechnology. 3 Credits.

An introduction to the basic principles of biochemistry and molecular biology as well as pharmacokinetics and pharmacodynamics of drug action. Additional lectures will introduce students to principles of genomics, transgenic technologies and microscopy. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology.

P&TX 751. Pharmacology II - Endocrine Pharmacology. 2 Credits.

A detailed study of the fundamental concepts of endocrinology with an emphasis on the pathophysiologic details of diabetes and the pharmacology of treatment. Brief discussions on hypothalamic/pituitary, reproductive, thyroid and adrenal endocrinology and pharmacology will be presented. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology and completion of P&TX 750.

P&TX 752. Pharmacology III- Central Nervous System and Autonomic Nervous System. 4 Credits.

A detailed study of the fundamental concepts of the autonomic nervous system, central nervous system, and select diseases of the CNS and their pharmacology. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology and completion of P&TX 750.

P&TX 753. Pharmacology IV- Cardiovascular and Renal System. 2 Credits.

A detailed study of the fundamental principles of the cardiovascular system, renal system and their associated pharmacology. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology and completion of P&TX 750.

P&TX 754. Pharmacology V - Immunopharmacology, Infectious Diseases and Gastrointestinal Pharmacology. 2 Credits.

This course is a detailed study of the fundamental concepts of immunology, inflammatory-related diseases and immunopharmacology, infectious diseases and gastrointestinal pharmacology. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology and completion of P&TX 750.

P&TX 755. Molecular Toxicology. 2 Credits.

A detailed study of the fundamentals of the toxicology, drug transformations and the mode of toxicity of various drug classes.

Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology and completion of P&TX 750.

P&TX 756. Receptor Pharmacology and Cell Signaling. 2 Credits.

A detailed study of the fundamental concepts of receptor pharmacology with an emphasis on the structures, functions, and pharmacology of G-protein signaling, ion channels, nuclear receptors and kinase signaling. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology and completion of P&TX 750.

P&TX 758. Pharmacogenomics. 2 Credits.

A detailed study of fundamental concepts of pharmacogenomics - how genes and genetic variation determine interindividual differences in drug response - experimental approaches, select gene-drug examples, translation from research to clinical use, and ethical, legal and social implications. Prerequisites: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology.

P&TX 759. Communication in Biomedical Sciences. 2 Credits.

Lectures and practical experience in written and oral communication skills, featuring various types of scientific writing. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology and completion of at least 4 courses from the P&TX 750 – P&TX 755 series.

P&TX 760. Optogenetic, Two Photon Imaging and Microscopy and Image Analysis Techniques in Neuropharmacology. 2 Credits.

An in-depth presentation of the use of optogenetics and two photon imaging in exploring synaptic plasticity in the CNS. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology and completion of at least 4 courses from the P&TX 750 – P&TX 755 series.

P&TX 761. Journal Club. 1 Credits.

Students will participate in student-lead journal club discussions and lead one journal club discussion under the mentorship of a faculty member. This is a synchronous course that online students join via video conferencing so students must be available during the regularly scheduled departmental journal club class. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology and completion of at least 4 courses from the P&TX 750 – P&TX 755 series.

P&TX 785. Research Proposal. 2 Credits.

To satisfy the research requirement for the Distance M.S. program in Pharmacology and Toxicology, the aspiring student must define a research project and prepare a written proposal describing the nature and goals of the project. It is suggested that the student in conjunction with their distance research mentor collaborate in the selection of and the definition of the proposed research. The proposal should be 4 pages (0.5 in margins, 11-12 point Arial, Times Roman or Calibri font) that states the overall goal of the project, the hypothesis to be tested, 2-3 specific aims, a statement of significance and impact of the research and research approach. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology, and completion of P&TX 750.

P&TX 799. Pharmacology and Toxicology Seminar. 1-2 Credits.

A review of current literature and research in pharmacology and toxicology. Required of all graduate students in the department every fall and spring semester. Graded on a satisfactory/unsatisfactory basis. Prerequisite: Graduate standing in P&TX.

P&TX 800. Pharmacology and Toxicology Teaching Principles. 2 Credits.

This course is to be used by graduate students fulfilling the teaching requirements for the Ph.D. in pharmacology and toxicology. The student will function as a discussion leader and lecturer in a limited number of class sessions. Each student will meet with the faculty whom he or

she is assisting. Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

P&TX 801. Issues in Scientific Integrity. 1 Credits.

Lectures and discussion on ethical issues in the conduct of a scientific career, with emphasis on practical topics of special importance in molecular-level research in the chemical, biological, and pharmaceutical sciences. Topics will include the nature of ethics, the scientist in the laboratory, as author, grantee, reviewer, employer/employee, teacher/student, and citizen. Discussions will focus on case histories. This course is open only to distance education students. Graded on a satisfactory/unsatisfactory basis. (Same as MDCM 801, NURO 801, PHCH 801 and PHCH 802.)

P&TX 803. Pharmacology Literature Review I. 1 Credits.

This course is designed for graduate students and will fulfill the first written exam requirement for the Ph.D. in pharmacology and Toxicology. The student will research and write a six page literature review by choosing a topic provided by the faculty. Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

P&TX 805. Pharmacology Literature Review II. 1 Credits.

This course is designed for graduate students and will fulfill the second written exam requirement for the Ph.D. in pharmacology and Toxicology. The student will research and write a twelve page literature review by choosing a topic provided by the faculty. Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

P&TX 806. Literature MS Thesis. 4 Credits.

This course is intended to be the final course in the program and will be used to complete the literature-based research proposal. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology and completion of at least 26 credit hours.

P&TX 825. Research in Pharmacology and Toxicology. 1-10 Credits.

Original investigations at an advanced level in the areas of pharmacology or toxicology or related fields. This research will be performed by graduate students in collaboration with a faculty member. Prerequisite: Graduate standing and consent of instructor.

P&TX 826. Online Research in Pharmacology and Toxicology. 8 Credits.

Original investigations at an advanced level in the areas of pharmacology or toxicology or related fields. This research will be performed by graduate students in collaboration at their place of off-site mentoring in collaboration with the faculty mentor. Prerequisite: Graduate standing in the Online M.S. Program in Pharmacology and Toxicology and consent of KU Pharmacology and Toxicology Faculty Mentor.

P&TX 885. Distance Master's Research in Pharmacology and Toxicology. 1-12 Credits.

Original investigations at an advanced level in areas of pharmacology or toxicology or related fields. This research will be performed by graduate students in collaboration at their place of off-site mentoring in collaboration with the faculty mentor. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology and completion of 12 credits in P&TX 785.

P&TX 889. Distance Master's Thesis. 2 Credits.

Independent investigation of a research problem of limited scope, leading to the preparation of a written Master's Degree thesis. Prerequisite: Graduate standing in the Distance M.S. Program in Pharmacology and Toxicology and completion of 12 credits in P&TX 885.

P&TX 890. Distance M.S. Thesis. 2 Credits.

Independent investigation of a research problem of limited scope, leading to the preparation of a written Master's Degree thesis. Prerequisite: Graduate standing in the On-line M.S. Program in Pharmacology and Toxicology.

P&TX 898. Online Master's Thesis. 1-2 Credits.

Independent investigation of a research problem of limited scope leading to the preparation of a written Master's Degree thesis. Prerequisite: Graduate standing in the Online M.S. Program in Pharmacology and Toxicology.

P&TX 899. Master's Thesis. 1-11 Credits.

Hours and credit to be arranged. Independent investigation of a research problem of limited scope. Prerequisite: Graduate standing in Pharmacology and Toxicology Program and consent of instructor.

P&TX 999. Doctoral Dissertation. 1-11 Credits.

Hours and credit to be arranged. Original investigation in pharmacology and toxicology. Prerequisite: Consent of instructor.

Pharmacy Courses

PHAR 101. Introduction to Medications in Healthcare - Pills, Potions, and Plants. 1 Credits.

This course serves as an introduction to modern medication therapy while also discussing critically important historical medications. Students will have the opportunity to explore drug therapy related to many common topics and disease states such as mental health disorders, substance abuse hypertension, diabetes mellitus, asthma, viral and bacterial infections, critical care (e.g., hospital ICU), vaccines, hormones and contraceptives, and pain disorders including the use of opioids. This course is designed for KU students who are interested in pursuing a healthcare career and establishing a pharmacologic foundation for a variety of respective disciplines. This includes but is not limited to: medicine, pharmacy, nursing, physician assistant, physical therapy, occupational therapy, and respiratory therapy.

PHAR 500. Introduction to Pharmacy. 1 Credits.

This course is designed to introduce pharmacy students to the profession of pharmacy, potential career pathways, and available academic and post-doctoral educational opportunities. Additionally, topics such as professionalism, leadership, professional advocacy, empathy, cultural competency, self-directed learning, interprofessional education, and professional communication will be discussed. Students will receive instruction and fulfill the prerequisites for their Introductory Pharmacy Practice Experiences (IPPE) occurring in the summer semesters of the PharmD program.

PHAR 509. History of Pharmacy Elective. 1 Credits.

This course is comprised of a survey of historical highlights of the development of Pharmacy as a discipline. The course will cover early antecedents of pharmacy, development of the discipline in Europe and the United States, the development of professional organizations, standards, education, and literature, economic development, and the pharmacists' contributions to community service, science, and the industry. There will be a mix of some lectures, discussion, assigned readings, and short papers. Prerequisite: Students must have first, second or third year professional standing in the School of Pharmacy.

PHAR 510. Pharmacy Skills I-A. 1 Credits.

The Professional Activities Lab curriculum is a team-taught, 6-semester, 10-credit hour laboratory sequence designed to prepare students to perform Entrustable Professional Activities (EPAs) for pharmacy practice prior to milestone examinations and experiential rotations. Lab activities will focus on students' exposure to, hands-on-practice of, and competency of a variety of pharmacy-specific skills. The P1

year will focus on community pharmacy related skills and activities, the P2 year will focus on institutional pharmacy skills, and the P3 year will focus on advanced pharmacy practice skills across multiple settings. As students progress through the 6-semester sequence, they will be expected to increasingly combine physical assessment, communication, patient counseling, and drug information skills, along with applying pharmacotherapy knowledge towards patient-care related activities. A variety of teaching and assessment modalities will be used including but not limited to podcasts, online quizzes, active-learning games, role playing, standardized patients, high-fidelity simulator mannequins, online modules, and traditional exams. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Students must have first year professional standing in the School of Pharmacy.

PHAR 512. Pharmacy Skills I-B. 1 Credits.

The Professional Activities Lab curriculum is a team-taught, 6-semester, 10-credit hour laboratory sequence designed to prepare students to perform Entrustable Professional Activities (EPAs) for pharmacy practice prior to milestone examinations and experiential rotations. Lab activities will focus on students' exposure to, hands-on-practice of, and competency of a variety of pharmacy-specific skills. The P1 year will focus on community pharmacy related skills and activities, the P2 year will focus on institutional pharmacy skills, and the P3 year will focus on advanced pharmacy practice skills across multiple settings. As students progress through the 6-semester sequence, they will be expected to increasingly combine physical assessment, communication, patient counseling, and drug information skills, along with applying pharmacotherapy knowledge towards patient-care related activities. A variety of teaching and assessment modalities will be used including but not limited to podcasts, online quizzes, active-learning games, role playing, standardized patients, high-fidelity simulator mannequins, online modules, and traditional exams. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Students must have first year professional standing in the School of Pharmacy.

PHAR 514. Scientific Writing for the Health Professional. 2 Credits.

Communicating research plans and experimental finding is a critical skill for health care professionals working in a research environment, and successful communication depends on clarity of thought and careful use of language. This course is intended for 3rd professional (P3) year students who are seeking residencies or fellowships and will need to write research proposals and abstracts, as well as prepare effective posters and presentations. It is an intensive course with multiple writing assignments. Students are expected to participate fully, and individual feedback and guidance on writing will provided by the instructor. Graded on a satisfactory/fail basis. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Students must be in their third professional year (P3).

PHAR 515. Pharmacy Skills II-A. 1 Credits.

The Professional Activities Lab curriculum is a team-taught, 6-semester, 10-credit hour laboratory sequence designed to prepare students to perform Entrustable Professional Activities (EPAs) for pharmacy practice prior to milestone examinations and experiential rotations. Lab activities will focus on students' exposure to, hands-on-practice of, and competency of a variety of pharmacy-specific skills. The P1 year will focus on community pharmacy related skills and activities, the P2 year will focus on institutional pharmacy skills, and the P3 year will focus on advanced pharmacy practice skills across multiple settings. As students progress through the 6-semester sequence, they will be expected to increasingly combine physical assessment, communication, patient counseling, and drug information skills, along with applying pharmacotherapy knowledge towards patient-care related activities. A

variety of teaching and assessment modalities will be used including but not limited to podcasts, online quizzes, active-learning games, role playing, standardized patients, high-fidelity simulator mannequins, online modules, and traditional exams. Prerequisite: Students must have first year professional standing in the School of Pharmacy. Students must have successfully completed PHAR 510 and PHAR 512; and current enrollment or successful completion of PHAR 517 and PHPR 661.

PHAR 516. Oral Presentations for the Health Professional. 1 Credits.

Communicating research plans and experimental findings is a critical skill for health care professionals working in a research environment, and a successful oral presentation depends on clear thinking and careful slide design to tell a story. This course is intended for 3rd year professional (P3) pharmacy students who are seeking residency and will need to prepare effective presentations. It is an intensive course with successive slide drafts and presentations. Students are expected to participate fully, and individual feedback and guidance on presentations will be provided by the other students and by the instructor. Graded on a satisfactory/fail basis. Prerequisite: Students must have third year professional standing in the School of Pharmacy. Students must have successfully completed PHAR 514 or consent of instructor.

PHAR 517. Pharmacy Skills II-B. 1 Credits.

The Professional Activities Lab curriculum is a team-taught, 6-semester, 10-credit hour laboratory sequence designed to prepare students to perform Entrustable Professional Activities (EPAs) for pharmacy practice prior to milestone examinations and experiential rotations. Lab activities will focus on students' exposure to, hands-on-practice of, and competency of a variety of pharmacy-specific skills. The P1 year will focus on community pharmacy related skills and activities, the P2 year will focus on institutional pharmacy skills, and the P3 year will focus on advanced pharmacy practice skills across multiple settings. As students progress through the 6-semester sequence, they will be expected to increasingly combine physical assessment, communication, patient counseling, and drug information skills, along with applying pharmacotherapy knowledge towards patient-care related activities. A variety of teaching and assessment modalities will be used including but not limited to podcasts, online quizzes, active-learning games, role playing, standardized patients, high-fidelity simulator mannequins, online modules, and traditional exams. Prerequisite: Students must have first year professional standing in the School of Pharmacy. Students must have successfully completed PHAR 510 and PHAR 512; and current enrollment or successful completion of PHAR 515 and PHPR 661.

PHAR 520. Pharmacy Skills III. 1 Credits.

Exercises that reinforce the concepts taught in pharmacy practice, pharmaceutical chemistry, medicinal chemistry, and pharmacology courses. Includes exercises in compounding, dispensing, and patient counseling. Prerequisite: Students must be admitted to the school of Pharmacy and have successfully completed PHPR 661 and PHAR 515 and PHAR 517 and have successfully completed or be concurrently enrolled in PHPR 662 to enroll in this course.

PHAR 525. Pharmacy Skills IV. 1 Credits.

Exercises that reinforce the concepts taught in pharmacy practice, pharmaceutical chemistry, medicinal chemistry, and pharmacology courses. Includes exercises in compounding, dispensing, and patient counseling. Prerequisite: Students must have second year professional standing in the School of Pharmacy and successfully completed PHPR 662, PHAR 520 and current enrollment or successful completion of PHPR 663.

PHAR 530. Pharmacy Skills V. 1 Credits.

Exercises that reinforce the concepts taught in pharmacy practice, pharmaceutical chemistry, medicinal chemistry, and pharmacology courses. Includes exercises in compounding, dispensing, and patient counseling. Prerequisite: Students must be admitted to the school of Pharmacy and have successfully completed PHPR 663 and PHAR 525 and have successfully completed or be concurrently enrolled in PHPR 664 to enroll in this course.

PHAR 535. Pharmacy Skills VI. 1 Credits.

Exercises that reinforce the concepts taught in pharmacy practice, pharmaceutical chemistry, medicinal chemistry, and pharmacology courses. Includes exercises in compounding, dispensing, and patient counseling. Prerequisite: Students must have third year professional standing in the School of Pharmacy. Students must have successfully completed PHAR 530 and PHPR 664; and current enrollment or successful completion of PHAR 537.

PHAR 537. Pharmacy Skills VIB. 1 Credits.

This laboratory course will allow students to develop clinical assessment skills necessary in the provision of pharmaceutical care to patients with a variety of disease states. Students will combine physical assessment skills, patient counseling skills, and pharmacotherapy knowledge and apply this information to patient care related activities in various clinical settings. Students will apply their skills using various practice models that include medication therapy management, collaborative drug therapy management, and interprofessional healthcare teams. The lab component will require students to meet between 1:00 to 5:00PM on either Monday, Tuesday, or Wednesdays. Prerequisite: Students must have third year professional standing in the School of Pharmacy. Students must have successfully completed PHAR 530 and PHPR 664; and current enrollment or successful completion of PHAR 535.

PHAR 550. Introductory Pharmacy Practice Experience - Community. 4 Credits.

A required four credit hour experiential course involving 160 hours of on-site experiential education. The course is designed to provide the student pharmacist with exposure to the practice of pharmacy in either an independent community or chain pharmacy in either a rural or urban setting within the state of Kansas. Graded on a satisfactory/unsatisfactory basis. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Students must have successfully completed PHAR 500.

PHAR 560. Introductory Pharmacy Practice Experience - Institutional. 4 Credits.

A required four credit hour experiential course years involving 160 hours of on-site experiential education. The course is designed to provide the student pharmacist with exposure to the practice of pharmacy in an institutional health-system (hospital) environment in either a rural or urban setting within the state of Kansas. Graded on a satisfactory/unsatisfactory basis. Prerequisite: Students must have second or third year professional standing in the School of Pharmacy.

PHAR 599. Advanced Infectious Disease - Translational Case Studies. 2 Credits.

This course is an interdepartmental elective focusing on advanced clinical decision-making within the field of infectious diseases. Utilizing clinical infectious disease cases based off of real-life patients, students will assess and make therapeutic recommendations via team-based active-learning exercises. These activities aim prepare students for advanced pharmacy practice and residency experiences in acute care settings with complicated and challenging patients, by providing students hands-on instruction in reading and assessing patient data including laboratory values and radiology reports, following patient progress over multiple days and adjusting patient care plans based on new unforeseen data,

writing infectious diseases-specific SOAP notes, orally presenting patients using presentation styles expected for 4th year APPE rotations and residency rotations, and using basic scientific principles when determining appropriate courses of patient care. Additional professional preparation in "soft skills" will be provided. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Students must be in their third professional year (P3).

Pharmacy Practice Courses

PHPR 508. Hematology/Oncology Pharmacy. 2 Credits.

This course explores many cancer-related topics, including non-pharmacologic treatment modalities, complications of cancer and its treatment, supportive care issues, and precision medicine. It also reviews current cancer screening and prevention guidelines and cancer research. Various cancers are discussed, such as myeloma, pediatric cancers, and cancers of the bladder, kidneys, ovaries, and testes. Prerequisite: Students must have third year professional standing in the School of Pharmacy and have successfully completed MDCM 626.

PHPR 509. Medicare Part D. 1 Credits.

This elective course will focus on the understanding and active enrollment of patients into Medicare prescription drug benefit (Part D). Students will mainly focus on the understanding of Medicare eligibility, benefits, formulary requirements, and the administration of benefits. Students will also participate in community outreach which may focus on underserved patients. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Must be a 2nd or 3rd professional year standing in the School of Pharmacy.

PHPR 510. Medical Terminology Elective. 1 Credits.

This course provides the fundamentals for developing a medical vocabulary. The student will develop the ability to understand, define and utilize medical terminology and abbreviations used in patient care.

PHPR 515. The Aging Patient. 1 Credits.

This elective course is designed for the learner to explore many of the clinical considerations employed when caring for the aging patient within our health care system. The course will be devoted to exploring perceptions of the older adult patient, learning how the aging process can impact patient care, and identifying the role of the pharmacist in enhancing this care through the 5M's of geriatric care. Prerequisite: Students must have second or third year professional standing in the School of Pharmacy.

PHPR 517. Medication Safety and Error Prevention. 1 Credits.

This course introduces the student to medication safety and the technology as well as the tools used in error prevention. The student will also learn about adverse drug events including both medication errors and adverse drug reactions in hospital and retail pharmacy settings. Prerequisite: Students must have second or third year professional standing in the School of Pharmacy.

PHPR 519. Business Planning for Pharmacy. 1 Credits.

This course is designed for students interested in developing a business plan. Most pharmacists will have an opportunity to develop a new service, product line or even start a new business venture in their careers. Students need to know how to create a formal business plan and how to present the plan to decision makers. The course will cover the basic components and rationale of creating a formal a business plan. When finished students will be expected to have created a written business plan and will present their creation to the class. In this manner, students will gain experience in developing an idea into a plan. Prerequisite: Students must be admitted to the school of Pharmacy.

PHPR 520. Specialty Pharmacy. 1 Credits.

This course will review a variety of diseases including: multiple sclerosis, hepatitis C and autoimmune conditions (psoriasis, ulcerative colitis, etc) and the specialty medications used to treat these conditions. Specialty pharmacy accreditation standards as well as topic discussions reviewing many issues facing the specialty pharmacy industry will be discussed. Guest speakers from different specialty pharmacies in the greater Kansas City area will also present information on their career experiences. Prerequisite: Students must have second or third year professional standing in the School of Pharmacy.

PHPR 521. Practical Pediatrics. 1 Credits.

This course will expose students to conditions frequently encountered in pediatric care. Students will further develop knowledge and skills necessary to provide appropriate pediatric care in institutional, ambulatory, and community practice settings. The course will involve interactive lectures followed by case-based learning to promote student application of knowledge to relevant clinical situations. Prerequisite: Students must be admitted to the School of Pharmacy and must be in their 3rd professional year.

PHPR 522. Pharmacy-Based Travel Health Services. 1 Credits.

This course reviews pertinent problems traveling entails and services pharmacists can provide for traveling patients. The course will involve interactive lectures followed by case-based learning to promote student application of knowledge to relevant clinical situations. Following the completion of this course, students should be able to recognize the need to establish travel health services, the role of pharmacists in these services, identify the commonly encountered disease states and problems for travelers, and what components comprise travel health by utilizing comprehensive knowledge, skills and resources necessary to establish and deliver successful travel health service. Prerequisite: Students must be admitted to the School of Pharmacy and must be in their 2nd or 3rd professional year. Students must have successfully completed the APhA Pharmacy-Based Immunization Delivery program.

PHPR 523. Critical Care Problem-Based Learning. 1 Credits.

This is an elective course focusing on advanced clinical decision making within the field of critical care. Using clinical critical care cases, student will work as a team to assess and make therapeutic recommendations through problem-based learning exercises. These activities aim to prepare students for advanced pharmacy practice and residency experiences in acute care settings by providing instruction in application of primary literature to patient cases, following patient progress through emergency department and intensive care settings, and oral presentation of evidence-based patients cases. Additionally, students will participate in an acute care interprofessional simulation. Prerequisite: Students must be admitted to the School of Pharmacy and must be in their 3rd professional year.

PHPR 525. Ambulatory Care. 1 Credits.

This elective course will explore many of the clinical and practical considerations employed when caring for patients in the ambulatory care setting. The course will expose the learner to a variety of topics that impact the pharmacist's role in this practice setting, including collaborative practice agreements, patient case evaluations, communication skill development, and practice evaluation. The course will be facilitated by the ambulatory care practice group at The University of Kansas Health System and will prepare the student for advanced pharmacy practice and residency experiences in the ambulatory care setting. Prerequisite: P2 or P3 standing in the School of Pharmacy.

PHPR 526. Introduction to Pharmacy Residencies. 1 Credits.

This course is team-taught by KU clinical faculty with the support of pharmacy residency program directors, residency preceptors, and pharmacy residents. This course is designed to increase knowledge, interest, and confidence amongst students about residency training;

identify and develop the skills necessary to apply to residency programs; and increase the number of students obtaining residency positions upon graduation. Prerequisite: Third year professional standing in the School of Pharmacy and instructor consent.

PHPR 527. Advanced Psychiatric Pharmacy. 1 Credits.

This elective course is designed to provide learners with the opportunity to gain further clinical and practical considerations when caring for patients with psychiatric disorders and substance use disorders. The course will expose the learner to a variety of topics that impact the pharmacist's role in treating patients with psychiatric disorders. This course will help prepare students who are interested in the field of psychiatry. Prerequisite: Successful completion of PHPR 662.

PHPR 528. Infectious Diseases Therapeutic Drug Monitoring. 1 Credits.

This advanced elective course will focus on clinical application of vancomycin, aminoglycoside, and anti-fungal therapeutic drug monitoring utilizing multiple-day real patient cases. The course format will consist of alternating week(s) of online learning via calculation assignments and in-person class debriefing discussions. Prerequisite: P3 Standing in School of Pharmacy.

PHPR 529. Introduction to the Pharmaceutical Industry. 1 Credits.

This course introduces the foundations of the pharmaceutical industry, by first introducing the drug development process from investigational molecules to FDA approval and beyond. A variety of departments within the pharmaceutical industry will be explored, including but not limited to: Clinical development and operations, regulatory affairs, medical affairs and information, market access, sales and commercial operations, and pharmacovigilance. Additionally, pharmaceutical industry fellowships will be introduced, and projects will aid in the development of materials to assist in applications, interviews, and success in PhRMA. Prerequisite: P2 and P3 students enrolled at the KU School of Pharmacy are eligible to enroll in this course.

PHPR 531. Managed Care Pharmacy Practice. 1 Credits.

This survey course is motivated, designed and taught by current experts and practicing pharmacists in managed care. The instructors have real-world experience and subject matter expertise. The course is designed to provide students with current information in managed care and expose students to unique, non-traditional pharmacist opportunities. Students will be exposed to the current practice of each pharmacist and explore the spectrum of managed care pharmacy. Clinical and pharmacy management, regulatory and practice topics will be covered in the course. The US health care system is complex. A solid understanding of how managed care pharmacy practice works benefits all stakeholders and especially students. Having completed the course students will be better equipped to practice pharmacy in any professional setting. Prerequisite: P2 standing in the School of Pharmacy or above to take this elective course. Students need to have completed PHPR 619.

PHPR 541. Foundations of Interprofessional Collaboration I. 0 Credits.

This TeamSTEPS Level 1 experience will introduce interprofessional students to the basic concepts of interprofessional collaboration including values and ethics, roles and responsibilities of healthcare team members, and interprofessional communication tools using the evidence-based national curriculum of TeamSTEPS. Upon completion of this training experience students will be able to 1) demonstrate a work ethic with individuals of other professions to maintain a climate of mutual respect and shared values; 2) define the role of health professions (including your own) within the healthcare system; 3) identify opportunities to seek expertise of health professionals to improve communication and

healthcare; and 4) acquire basic TeamSTEPPS communication tools to effectively use with healthcare teams. Graded on a satisfactory/unsatisfactory basis. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Student must have P1 standing in the School of Pharmacy.

PHPR 542. Foundations of Interprofessional Collaboration II. 0 Credits.

This TeamSTEPPS Level 2 experience will provide interprofessional students opportunities to apply key knowledge and skills gained in FIPC I, through role-play and case-based learning. Students will apply their knowledge of roles and responsibilities of healthcare team members and interprofessional communication tools and continue learning with, from, and about students from other professions. Upon completion of this training experience students will be able to: 1) engage diverse healthcare professionals who complement one's own professional expertise, as well as associated resources, to develop strategies to meet specific patient care needs; 2) choose effective communication tools and techniques, including information systems and communication technologies, to facilitate discussions and interactions that enhance team function; and 3) engage other health professionals appropriate to the specific care situation--in shared patient-centered problem-solving. Graded on a satisfactory/unsatisfactory basis. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Student must have P2 standing in the School of Pharmacy and successfully completed PHPR 661.

PHPR 543. Foundations of Interprofessional Collaboration III. 0 Credits.

This TeamSTEPPS Level 3 experience will provide interprofessional students opportunities to demonstrate key knowledge and skills gained in FIPC I and II, through simulation. Students will demonstrate their interprofessional communication skills, including specific opportunities to utilize TeamSTEPPS tools. Students will also demonstrate their teamwork abilities by working with interprofessional students during the simulation. Upon completion of this training experience students will be able to: 1) demonstrate communicating effectively with other health professionals about a patient case; 2) exhibit teamwork skills with an interprofessional healthcare team; and 3) utilize key TeamSTEPPS tools with an interprofessional healthcare team. Graded on a satisfactory/unsatisfactory basis. Prerequisite: Students must have third year professional standing in the School of Pharmacy. Students must have successfully completed PHPR 663.

PHPR 601. Advanced Pharmacy Practice Experience 1. 4 Credits.

The final year of the Doctor of Pharmacy program is spent participating in pharmacy practice experience rotations. These consist of nine, one-month rotations, in various health care settings. Such practice settings may include a variety of acute care, ambulatory care, managed care, hospital and community practice sites. Each rotation provides an academically structured environment that enables the student to gain practical experience under the guidance of a practicing health care professional. The purpose of providing pharmacy students with a pharmacist role model is to foster the development of both professional confidence as well as competence. These practice-based experience settings encourage the student to apply their didactic education to clinical problem solving. Both clinical and distributive pharmacy services will be integrated in these experiences for optimal learning. This course is graded using an "Excellent", "Satisfactory", or "Unsatisfactory" grading basis.

PHPR 602. Advanced Pharmacy Practice Experience 2. 4 Credits.

The final year of the Doctor of Pharmacy program is spent participating in pharmacy practice experience rotations. These consist of nine, one-month rotations, in various health care settings. Such practice settings may

include a variety of acute care, ambulatory care, managed care, hospital and community practice sites. Each rotation provides an academically structured environment that enables the student to gain practical experience under the guidance of a practicing health care professional. The purpose of providing pharmacy students with a pharmacist role model is to foster the development of both professional confidence as well as competence. These practice-based experience settings encourage the student to apply their didactic education to clinical problem solving. Both clinical and distributive pharmacy services will be integrated in these experiences for optimal learning. This course is graded using an "Excellent", "Satisfactory", or "Unsatisfactory" grading basis.

PHPR 603. Advanced Pharmacy Practice Experience 3. 4 Credits.

The final year of the Doctor of Pharmacy program is spent participating in pharmacy practice experience rotations. These consist of nine, one-month rotations, in various health care settings. Such practice settings may include a variety of acute care, ambulatory care, managed care, hospital and community practice sites. Each rotation provides an academically structured environment that enables the student to gain practical experience under the guidance of a practicing health care professional. The purpose of providing pharmacy students with a pharmacist role model is to foster the development of both professional confidence as well as competence. These practice-based experience settings encourage the student to apply their didactic education to clinical problem solving. Both clinical and distributive pharmacy services will be integrated in these experiences for optimal learning. This course is graded using an "Excellent", "Satisfactory", or "Unsatisfactory" grading basis.

PHPR 604. Advanced Pharmacy Practice Experience 4. 4 Credits.

The final year of the Doctor of Pharmacy program is spent participating in pharmacy practice experience rotations. These consist of nine, one-month rotations, in various health care settings. Such practice settings may include a variety of acute care, ambulatory care, managed care, hospital and community practice sites. Each rotation provides an academically structured environment that enables the student to gain practical experience under the guidance of a practicing health care professional. The purpose of providing pharmacy students with a pharmacist role model is to foster the development of both professional confidence as well as competence. These practice-based experience settings encourage the student to apply their didactic education to clinical problem solving. Both clinical and distributive pharmacy services will be integrated in these experiences for optimal learning. This course is graded using an "Excellent", "Satisfactory", or "Unsatisfactory" grading basis. Prerequisite: Students must have fourth year professional standing in the School of Pharmacy.

PHPR 605. Advanced Pharmacy Practice Experience 5. 4 Credits.

The final year of the Doctor of Pharmacy program is spent participating in pharmacy practice experience rotations. These consist of nine, one-month rotations, in various health care settings. Such practice settings may include a variety of acute care, ambulatory care, managed care, hospital and community practice sites. Each rotation provides an academically structured environment that enables the student to gain practical experience under the guidance of a practicing health care professional. The purpose of providing pharmacy students with a pharmacist role model is to foster the development of both professional confidence as well as competence. These practice-based experience settings encourage the student to apply their didactic education to clinical problem solving. Both clinical and distributive pharmacy services will be integrated in these experiences for optimal learning. This course is graded using an "Excellent", "Satisfactory", or "Unsatisfactory" grading basis. Prerequisite: Students must have fourth year professional standing in the School of Pharmacy.

PHPR 606. Advanced Pharmacy Practice Experience 6. 4 Credits.

The final year of the Doctor of Pharmacy program is spent participating in pharmacy practice experience rotations. These consist of nine, one-month rotations, in various health care settings. Such practice settings may include a variety of acute care, ambulatory care, managed care, hospital and community practice sites. Each rotation provides an academically structured environment that enables the student to gain practical experience under the guidance of a practicing health care professional. The purpose of providing pharmacy students with a pharmacist role model is to foster the development of both professional confidence as well as competence. These practice-based experience settings encourage the student to apply their didactic education to clinical problem solving. Both clinical and distributive pharmacy services will be integrated in these experiences for optimal learning. This course is graded using an "Excellent", "Satisfactory", or "Unsatisfactory" grading basis. Prerequisite: Students must have fourth year professional standing in the School of Pharmacy.

PHPR 607. Advanced Pharmacy Practice Experience 7. 4 Credits.

The final year of the Doctor of Pharmacy program is spent participating in pharmacy practice experience rotations. These consist of nine, one-month rotations, in various health care settings. Such practice settings may include a variety of acute care, ambulatory care, managed care, hospital and community practice sites. Each rotation provides an academically structured environment that enables the student to gain practical experience under the guidance of a practicing health care professional. The purpose of providing pharmacy students with a pharmacist role model is to foster the development of both professional confidence as well as competence. These practice-based experience settings encourage the student to apply their didactic education to clinical problem solving. Both clinical and distributive pharmacy services will be integrated in these experiences for optimal learning. This course is graded using an "Excellent", "Satisfactory", or "Unsatisfactory" grading basis. Prerequisite: Students must have fourth year professional standing in the School of Pharmacy.

PHPR 608. Advanced Pharmacy Practice Experience 8. 4 Credits.

The final year of the Doctor of Pharmacy program is spent participating in pharmacy practice experience rotations. These consist of nine, one-month rotations, in various health care settings. Such practice settings may include a variety of acute care, ambulatory care, managed care, hospital and community practice sites. Each rotation provides an academically structured environment that enables the student to gain practical experience under the guidance of a practicing health care professional. The purpose of providing pharmacy students with a pharmacist role model is to foster the development of both professional confidence as well as competence. These practice-based experience settings encourage the student to apply their didactic education to clinical problem solving. Both clinical and distributive pharmacy services will be integrated in these experiences for optimal learning. This course is graded using an "Excellent", "Satisfactory", or "Unsatisfactory" grading basis. Prerequisite: Students must have fourth year professional standing in the School of Pharmacy.

PHPR 609. Advanced Pharmacy Practice Experience 9. 4 Credits.

The final year of the Doctor of Pharmacy program is spent participating in pharmacy practice experience rotations. These consist of nine, one-month rotations, in various health care settings. Such practice settings may include a variety of acute care, ambulatory care, managed care, hospital and community practice sites. Each rotation provides an academically structured environment that enables the student to gain practical experience under the guidance of a practicing health care professional. The purpose of providing pharmacy students with a pharmacist role model is to foster the development of both professional confidence as well

as competence. These practice-based experience settings encourage the student to apply their didactic education to clinical problem solving. Both clinical and distributive pharmacy services will be integrated in these experiences for optimal learning. This course is graded using an "Excellent", "Satisfactory", or "Unsatisfactory" grading basis. Prerequisite: Students must have fourth year professional standing in the School of Pharmacy.

PHPR 610. Advanced Pharmacy Practice Experience 10. 4 Credits.

The final year of the Doctor of Pharmacy program is spent participating in nine pharmacy practice experience rotations (PHPR 601-609). PHPR 610 is reserved for students requiring a remedial experiential rotation. This course is graded using an "Excellent", "Satisfactory", or "Unsatisfactory" grading basis. Prerequisite: Students must have fourth year professional standing in the School of Pharmacy.

PHPR 613. Pharmacoeconomics and Health Outcomes. 2 Credits.

A course to foster an understanding of economic, financial and outcome principles that drive the demand and supply of medical care in the US. Economic logic behind decisions made by patients, physicians, hospitals, managed care organizations, and governments will be covered. Students completing this course should be able to identify the drivers of the health economy, identify different types of pharmacoeconomic evaluations, critically analyze pharmacoeconomic and outcome literature, and apply economic principles to pharmaceutical care. Prerequisite: Students must have third year professional standing in the School of Pharmacy.

PHPR 614. Pharmacy Management. 3 Credits.

A course designed to provide knowledge and skills to effect efficient and effective pharmacy management. This will include foundations in financial management, inventory control, purchasing, cost-effective drug utilization, quality management, pharmacoeconomics, and human resource management.

PHPR 618. Hospital and Health-System Pharmacy. 1 Credits.

Introduction to pharmacy services within health-system pharmacies with an emphasis on medication distribution systems, parenteral and sterile products, clinical pharmacy practice and other services. Prerequisite: Must be accepted to the Pharmacy program.

PHPR 619. Health Care Systems and Informatics. 3 Credits.

This course is an introduction to the organization, financing, and delivery of health care services with a focus on the U.S. health care system. Course content addresses the following questions: how do we evaluate the health care sector, where is health care provided, how is health care financed, what are the characteristics of health care providers (individuals and institutions), what influences the performance of the health care sector, and what lies in the future for health care delivery. The purpose of the course is to prepare pharmacy students for non-clinical aspects of their practice sites. Enrollment limited to pharmacy majors. Prerequisite: Students must have first year professional standing in the School of Pharmacy.

PHPR 620. Ethical, Legal, and Cultural Issues in Patient Care. 2 Credits.

This course provides an introduction to the fundamentals of law and ethics as they apply to the practice of pharmacy. Course sessions will focus on ethical expectations of the profession, principles and issues in medical and pharmacy ethics, and laws that govern medication dispensing.

PHPR 621. Pharmacy Law. 2 Credits.

A course developed to increase students' knowledge and understanding of laws that regulate the pharmacy profession. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course.

Students must be in their third professional year standing in the School of Pharmacy and eligible for APPE rotations at the conclusion of the semester.

PHPR 624. Pharmacoepidemiology and Public Health. 2 Credits.

Pharmacy profession has a unique and critical opportunity and responsibility to contribute to the improvement of population health. Public health is a broader discipline that encompasses population health with a variety of other areas, including but not limited to epidemiology, cultural competence, health promotion, disease prevention, and drug safety. Pharmacoepidemiology is the application of the principles of epidemiology to the study of medications and their effects. Considerations are centered on providing beneficial or adverse effects of medication use in large populations and making relevant inferences from essential analytical research designs used in public health. Using population-based-care approach, students will adopt and fulfill public health roles and activities. This course provides a broad introduction to the principles of pharmacoepidemiology and public health with a focus on applications in the field of pharmacy. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Students must have P3 standing in the School of Pharmacy.

PHPR 629. Research Design and Biostatistics. 2 Credits.

This course reviews study designs and statistical methods commonly used in primary medical literature. In collaboration with other courses in the curriculum, this course prepares students to interpret and apply primary literature during patient care, collect and analyze data, and maintain clinical competency throughout their professional career in pharmacy. Following completion of this course, students should be able to identify or select appropriate research methods and study designs; collect, summarize and interpret research data; understand basic statistical concepts; identify or select appropriate statistical tests for hypothesis testing; conduct and interpret the results of statistical tests; and evaluate the validity and reliability of published research studies.

PHPR 630. Drug Information and Literature Evaluation. 1 Credits.

This course will review the fundamental tools used to identify drug information in primary, secondary and tertiary resources. In addition, students will learn to assess published literature, utilize electronic resources, and learn to formulate a response to drug information questions. Following completion of this course, students will be able to understand the strengths and weaknesses of the drug information resources and to apply drug information skills to clinical practice relevant to patient care. Prerequisite: Successful completion of PHPR 629 and Fifth year standing (P3 student).

PHPR 635. Problems in Pharmacy Practice. 1-5 Credits.

A course designed for the study of special topics in pharmacy practice. A research paper will be required. Prerequisite: Consent of instructor.

PHPR 661. Pharmacotherapy I. 4 Credits.

A course dealing with the clinical applications of drug knowledge to patient care. Drug interactions and patient counseling techniques will be covered. Over-the-counter medications and herbals will also be a significant portion of the course. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Student must have first year professional standing in the School of Pharmacy and successfully completed PHAR 510, PHAR 512 and concurrent enrollment or successfully completed PHAR 515 and PHAR 517.

PHPR 662. Pharmacotherapy II. 4 Credits.

A course dealing with the clinical applications of drug knowledge to patient care. Disease and drug knowledge will be applied to the design and monitoring of therapeutic treatment plans for patients. Prerequisite: Students must be admitted to the school of Pharmacy and have

successfully completed PHPR 661 and PHAR 515 and PHAR 517 to enroll in this course.

PHPR 663. Pharmacotherapy III. 4 Credits.

A course dealing with the clinical applications of drug knowledge to patient care. Disease and drug knowledge will be applied to the design and monitoring of therapeutic treatment plans for patients. Prerequisite: Students must be admitted to the school of Pharmacy to enroll in this course. Student must have second year professional standing in the School of Pharmacy and successfully completed PHPR 662 and PHAR 520.

PHPR 664. Pharmacotherapy IV. 4 Credits.

A course dealing with the clinical applications of drug knowledge to patient care. Disease and drug knowledge will be applied to the design and monitoring of therapeutic treatment plans for patients. Prerequisite: Students must be admitted to the school of Pharmacy and have successfully completed PHPR 663 and PHAR 525 to enroll in this course.

PHPR 665. Pharmacotherapy V. 4 Credits.

A course dealing with the clinical applications of drug knowledge to patient care. Disease and drug knowledge will be applied to the design and monitoring of therapeutic treatment plans for patients. Prerequisite: Students must have third year professional standing in the School of Pharmacy. Students must have successfully completed PHAR 530 and PHPR 664.

PHPR 670. Clinical Assessment. 2 Credits.

This laboratory course will allow students to develop clinical assessment skills necessary in the provision of pharmaceutical care to patients with a variety of disease states. Students will combine physical assessment skills, patient counseling skills, and pharmacotherapy knowledge and apply this information to patient care related activities in various clinical settings. Students will apply their skills using various practice models that include medication therapy management, collaborative drug therapy management, and interprofessional healthcare teams. The lab component will require students to meet between 1:00 to 5:00 PM on either Monday, Tuesday, or Wednesdays. In addition, there is a required Thursday discussion section. A detailed schedule of lab meeting dates and times will be provided in the syllabus. Prerequisite: Students must be admitted to the School of Pharmacy to enroll in this class. Students must pass PHPR 664 to be eligible to complete PHPR 670.

PHPR 690. Research in Pharmacy Practice. 1-5 Credits.

Students will conduct original research in a laboratory, educational, or clinical research setting under the supervision of department faculty. Prerequisite: Students must be admitted to the School of Pharmacy to enroll in this class.

PHPR 845. Professional Communications and Leadership. 2 Credits.

A course designed to give the graduate student a practical experience in areas of professional communications such as administrative proposals, grants, letters, memos, poster presentations, and written papers. The course focuses on the different kinds of communications required to relate to other health care professionals. Prerequisite: Consent of instructor.

PHPR 855. Economic Evaluation of Health Care Programs and Services. 3 Credits.

The course will provide students with an overview and appraisal of the "state-of-the-art" in the evaluation of health care programs and services (with a special emphasis on pharmaceutical programs, services, and products). The purpose of the course is to provide the student with the tools to conduct economic rather than general evaluation of health care programs and services. There will be some discussion of theoretical concepts, but the major emphasis will be on practical methodological

issues in economic evaluation of pharmaceutical programs. The course integrates the perspectives of pharmaceutical and health care technology assessment, managed care, outcomes research, and public health. The main topics covered in the course include: cost, cost-minimization, cost-effectiveness, cost-utility, and cost-benefit analyses.

PHPR 860. Seminar in Pharmacy Practice. 1 Credits.

Research reports, reviews, and/or presentations on the current status of various aspects of pharmacy practice. Prerequisite: Consent of instructor.

PHPR 865. Advanced Institutional Pharmacy Services I. 1.5 Credits.

Advanced Institutional Pharmacy Services (I) includes activities involving administrative and behavioral science techniques to manage 'the business of pharmacy practice'. Topics and information will be borrowed from the disciplines of business management, accounting, economics, finance, marketing, operations research and applied to the practice of pharmacy. Upon completion of the course, students should be able to explain, understand and apply pharmacy practice management techniques in the following general areas: business management, pharmacy financial management and operations management. Prerequisite: Consent of instructor.

PHPR 866. Advanced Institutional Pharmacy Services II. 1.5 Credits.

Advanced Institutional Pharmacy Services (II) includes activities involving administrative and behavioral science techniques to manage 'the business of pharmacy practice'. Topics and information will be borrowed from the disciplines of business management, accounting, economics, finance, marketing, operations research and applied to the practice of pharmacy. Upon completion of the course, students should be able to explain, understand and apply pharmacy practice management techniques in the following general areas: human resource management, clinical services management, specialty pharmacy services and technology management. Prerequisite: Consent of Instructor.

PHPR 899. Research in Pharmacy Practice. 1-6 Credits.

Original investigation in the area of pharmacy practice. Prerequisite: Consent of instructor.