Department of Pharmacology and Toxicology

Pharmacology and Toxicology Graduate Programs

The Department of Pharmacology and Toxicology has research strengths in neuropharmacology — especially in neurodegeneration, psychiatric disorders, and addiction — and the effects of diabetes on the nervous system. The research program is founded on strong Ph.D. and M.S. graduate programs.

Doctoral students are prepared to teach and do research in a university, pharmaceutical, biotechnology, or government laboratory setting. New Ph.D. students can look forward to personal development in an atmosphere that fosters strong collaborative activities as well as independent scholarship. The department recruits 4 to 5 Ph.D. students each year and offers stipends and tuition coverage.

The major aim of the MS degree program is to provide qualified graduates to institutions in academia, industry, and government. The Master of Science in Pharmacology and Toxicology program emphasizes student’s research skills in molecular and neuro-pharmacology and toxicology. In addition to the didactic component of our training, we view hands-on training in laboratory research critical to the master’s thesis experience.

The department’s research programs and faculty place it at the leading edge of research in the pharmacological and toxicological neurosciences.

Facilities

Research facilities offer a range of modern instrumentation and many research support services. Major instruments include tissue culture rooms, ultracentrifuges, scintillation counters, high-pressure liquid chromatography systems, a patch-clamp electrophysiology system with Nikon fluorescent microscope, microprocessor-controlled spectrophotometers and fluorometers including a dual excitation wavelength instrument for intracellular measurements and a time-resolved luminescence and fluorescence microplate reader with dual dispensing capabilities, a Seahorse Extracellular Flux Analyzer for measuring cell metabolism and major energy-producing pathways of the cell, a dark room with a film processor, and real-time PCR equipment.

University research support facilities also contribute to the high quality of research and training for graduate students. These facilities are fully staffed by professionals and include the Electron Microscopy Lab with transmission and scanning scopes; the Biochemical Research Services Lab for Illumina RNAseq, protein and DNA sequencing, amino acid analysis, and oligonucleotide and peptide syntheses; a High Throughput Laboratory for screening compounds as potential tools and drug development, and the Molecular Graphics and Modeling Lab with VAX computers, extensive databases for protein structures, and multiple molecular modeling programs an NMR facility; an X-ray Crystallography Laboratory; a Mass Spectrometry Laboratory; and an Instrumentation Design Laboratory. All labs have current computer technology, including hardware and extensive software for imaging, data analysis, data reduction, protein and gene analysis, and statistical tests.

Courses

P&TX 630. Pharmacology I. 4 Hours.
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 PTX 630 include, general principles of cell biology, molecular biology, pharmacogenomics, immunology and principles of drug metabolism and disposition. Prerequisite: BIOL 646 or equivalent. LEC.

P&TX 631. Pharmacology II. 3 Hours.
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: PTX 630 and BIOL 400 or equivalent. LEC.

P&TX 632. Pharmacology III. 3 Hours.
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: PTX 630 and PTX 631. LEC.

P&TX 633. Pharmacology IV. 3 Hours.
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 PTX 633 include endocrine disorders, diabetes and obesity, and gastrointestinal pharmacology. Prerequisite: PTX 630, PTX 631 and PTX 632. LEC.

P&TX 640. Toxicology. 2 Hours.
General principles of toxicology, treatment, and management of accidental poisoning, and current topics of interest. Prerequisite: PTX 630, PTX 631, and PTX 632. LEC.

P&TX 642. Obesity, Diabetes, and Metabolic Syndrome: Current Concepts. 1 Hour.
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: PTX 630. LEC.
P&TX 643. Current Concepts of Neurodegenerative Disease. 1 Hour.
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: PTX 630. LEC.

P&TX 644. Adverse Drug Events. 1 Hour.
The objective of this course is to alerts students to common and
preventable adverse drug events. This course will provide students with
an opportunity to read, examine, and report on a broad array of topics
relevant to adverse drug events. Students will be given broad latitude to
propose topics of interest to them within the area of adverse drug events.
In addition students can report on common and preventable food-drug,
herb-drug, and disease-drug interactions. The format of the course will be
group presentations. Groups of 3 students will identify a topic of interest
to them among a list of provided topics, prepare a 30 minute presentation
and deliver it to the class for discussion. Prerequisite: 3rd, 4th, or 5th
professional year standing in the School of Pharmacy. LEC.

P&TX 645. Neurobiological Basis of Addiction: Physiological,
Biochemical, Pharmacological & Treatment Concepts. 1 Hour.
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 PTX 632 or special permission
from faculty. LEC.

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

P&TX 698. Library Problems in Pharmacology and Toxicology. 1-5 Hours.
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
can not count toward pharmacology and toxicology requirements in the
School of Pharmacy. Prerequisite: PTX 635 and consent of instructor.
IND.

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

P&TX 730. Advanced Pharmacology I - CNS and ANS. 2 Hours.
A detailed study of the fundamentals of autonomic nervous system,
central nervous system, and their pharmacology. The student will attend
PTX 632 lectures and meet separately with the faculty for additional
discussions of advanced material on the topics. The students will be
examined on the advanced material. Prerequisite: Graduate standing in
Pharmacology and Toxicology Program. LEC.

P&TX 731. Advanced Pharmacology II - Cardiovascular and Renal
System. 2 Hours.
A detailed study of the fundamentals of cardiovascular system, renal
system and their pharmacology. The student will attend PTX 632 lectures
and meet separately with the faculty for additional discussions of
advanced material on the topics. The students will be examined on the
advanced material. Prerequisite: Graduate standing in Pharmacology and
Toxicology Program. LEC.

P&TX 732. Advanced Pharmacology III - Immunology and Inflammatory
Diseases. 2 Hours.
A detailed study of the fundamentals of immunology and inflammation
and their pharmacology. The student will attend PTX 632 lectures
and meet separately with the faculty for additional discussions of
advanced material on the topics. The students will be examined on the
advanced material. Prerequisite: Graduate standing in Pharmacology and
Toxicology Program. LEC.

P&TX 740. Advanced Biotechnology. 3 Hours.
An examination of basic principles of molecular biology, immunology,
and protein chemistry as they apply to the identification, production, stability,
delivery, and monitoring of new therapeutic agents provided by the
expanding biotechnology industry. Students will attend lectures in PTX
633 and meet separately with faculty for additional discussions of more
advanced material on these topics. The students will be examined on the
advanced material. Prerequisite: Graduate standing in Pharmacology and
Toxicology Program. LEC.

P&TX 741. Biomedical Statistics. 3 Hours.
This course is primarily intended for students concerned with the
analysis of experimental and observational data, with an emphasis on
biomedical and pharmacological applications. The topics covered by
the course include the design of experimental studies, data collection,
probability theory, descriptive statistics, probability distribution,
hypothesis testing, T-test, analyses of variance for factorial designs,
linear and multiple regression, analysis of covariance and non-parametric
methods. Prerequisite: PTX graduate student status in good academic
standing. LEC.

P&TX 742. Experimental Pharmacology. 4 Hours.
Experimental approaches to understanding mechanism of drug
action. Use of drugs as tools to understand functioning of biological
systems will also be stressed. Historically important experiments
will be discussed along with experiments which are currently used
to define drug mechanisms. Topics will include: dose-response, drug
receptors, drug metabolism, chemotherapy as well as autonomic CNS,
cardiocascular and renal pharmacology. Prerequisite: Graduate standing
in Pharmacology and Toxicology Program. LEC.

P&TX 747. Molecular Toxicology. 4 Hours.
A detailed study of the fundamentals of the experimental methods used
in a modern toxicology laboratory. The student will attend PTX 640
lectures and meet separately with the faculty for additional discussions of
advanced material on the topics. The students will be examined on the
advanced material. Prerequisite: Graduate standing in Pharmacology and
Toxicology Program. LEC.
P&TX 750. Pharmacology I- Introduction to Pharmacology and Biotechnology. 3 Hours.
An introduction to the field of Pharmacology, with an initial focus on the pharmacokinetics and pharmacodynamics of drug action in the body. The second section covers protein-based therapeutics, and biotechnology including an examination of basic principles of molecular biology, immunology, and protein chemistry as they apply to the identification, production, stability, delivery, and monitoring of new therapeutic agents provided by the expanding biotechnology industry. Prerequisite: Graduate standing in the Online M.S. Program in Pharmacology and Toxicology. LEC.

P&TX 751. Molecular Toxicology. 3 Hours.
A detailed study of the fundamentals of the experimental methods used in a modern toxicology laboratory. The course will also cover the mode of toxicity of a number of classes of drugs and the therapeutic approach to patient treatment. The student is also required to create their own 50 minute didactic lecture on a chosen topic within the field of toxicology in consultation with the course director. The student will then deliver the lecture to the course advisor in a digital format. Prerequisite: Graduate standing in the Online M.S. Program in Pharmacology and Toxicology. LEC.

P&TX 752. Pharmacology II- Central Nervous System and Autonomic Nervous System. 3 Hours.
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 Online M.S. Program in Pharmacology and Toxicology. LEC.

P&TX 753. Pharmacology III- Cardiovascular and Renal System. 2 Hours.
A detailed study of the fundamental principles of the cardiovascular system, renal system and their associated pharmacology. Prerequisite: Graduate standing in the Online M.S. Program in Pharmacology and Toxicology. LEC.

P&TX 754. Pharmacology IV- Endocrinology and Diabetes. 2 Hours.
A detailed study of the fundamental concepts of endocrinology and their associated pharmacology. A section with emphasis on the pathophysiologic details of diabetes and the pharmacology of treatment of the disease and associated complications is included. Prerequisite: Graduate standing in the Online M.S. Program in Pharmacology and Toxicology. LEC.

An overview of animal care and use, this course is designed for graduate students currently engaged in animal based research or that anticipate work with live animals. Topics covered include regulatory framework for animal research; animal facility operations; biology, husbandry, and care of common laboratory animal species; and experimental manipulation of laboratory animals. Emphasis is placed on practical experience with live animals. LEC.

P&TX 756. Pharmacology V- Inflammation & Immunology, Gastrointestinal Pharmacology, Reproductive Pharmacology. 2 Hours.
This course is a detailed study of the fundamental concepts of gastrointestinal pharmacology, reproductive pharmacology, the pharmacology of inflammatory-related diseases and immunological pharmacology. Prerequisite: Graduate standing in the Online M.S. Program in Pharmacology and Toxicology. LEC.

P&TX 757. Biomedical Statistics. 3 Hours.
This course is primarily intended for students concerned with the analysis of experimental and observational data, with an emphasis on biomedical and pharmacological applications. The topics covered by the course include the design of experimental studies, data collection, probability theory, descriptive statistics, probability distribution, hypothesis testing, T-test, analyses of variance for factorial designs, linear and multiple regression, analysis of covariance and non-parametric methods. Prerequisite: Graduate standing in the Online M.S. Program in Pharmacology and Toxicology. LEC.

P&TX 757. Chemistry of the Nervous System. 3 Hours.
A detailed study of the molecular aspects of nerve transmission will be covered with special emphasis on the uptake, storage, release, biosynthesis, and metabolism of specific neurotransmitters. Drugs affecting these processes and current research on receptor isolation and receptor mechanisms will be discussed from a chemical viewpoint. (Same as BIOL 775, CHEM 775, MDCM 775, NURO 775, and PHCH 775.) Prerequisite: BIOL 600 or equivalent. LEC.

P&TX 758. Research Proposal. 1 Hour.
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 consist of the following element: an overall goal or hypothesis, a statement of significance of the research, and a research plan consisting of several specific aims. Prerequisite: Graduate standing in the Online M.S. Program in Pharmacology and Toxicology. RSH.

P&TX 759. Pharmacology and Toxicology Seminar. 1-2 Hours.
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 PTX. LEC.

P&TX 800. Pharmacology and Toxicology Teaching Principles. 2 Hours.
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. RSH.

P&TX 801. Issues in Scientific Integrity. 1-3 Hours.
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, the scientist as author, grantee, reviewer, employer/employee, teacher, student, and citizen. Discussions will focus on case histories. Graded on a satisfactory/unsatisfactory basis. (Same as MDCM 801, NURO 801, PHCH 801 and PHCH 802.) LEC.

P&TX 803. Pharmacology Literature Review I. 1 Hour.
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. LEC.
P&TX 805. Pharmacology Literature Review II. 1 Hour.
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. LEC.

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

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

P&TX 889. Research in Pharmacology and Toxicology. 1-2 Hours.
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. RSH.

P&TX 898. Online Master's Thesis. 3 Hours.
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. THE.

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

P&TX 990. Postdoctoral Research. 1-11 Hours.
Advanced level research in collaboration with a faculty member in the department. Graded on a satisfactory/unsatisfactory basis. Prerequisite: Doctoral degree or equivalent in an appropriate related area, and consent of instructor. RSH.

P&TX 999. Doctoral Dissertation. 1-11 Hours.
Hours and credit to be arranged. Original investigation in pharmacology and toxicology. Prerequisite: Consent of instructor. THE.