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 control of energy metabolism and 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. The School of Pharmacy is ranked third in the nation for the NIH funding.

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 fluorimeters 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 599. Clinical Application of Basic Science. 1 Hour.
This course is an inter-departmental, team-based, technology-centric elective course. Concomitantly, instructors from the basic and clinical science departments within the school of pharmacy will promote deeper student understanding of the path a drug takes from discovery, development and ultimately clinical use. Instructors will collaborate in course content development to integrate basic and clinical science concepts. The course will utilize a blended learning method, incorporating out of class podcasts, online group collaborative projects, and readiness quizzes and exams. (Same as MDCM 599 and PHCH 599.) Prerequisite: 4th or 5th professional year standing (4P/5P) in the school of pharmacy and concomitant enrollment in PHPR 599 is required. LEC.

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. 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 631 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 632. Pharmacology III. 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 632 include, cardiovascular diseases, diuretics, autonomic pharmacology and drugs regulating central nervous system function. 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 641. Antibiotics: Benefits and Risks. 1 Hour.
Students will read and discuss the latest research on new antibiotic targets, therapeutic potential, disease prevention, and the emergence of antibiotic resistance. 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 may 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 - Cancer Biology and Inflammatory Diseases. 2 Hours.
A detailed study of the fundamentals of inflammation, cancer biology and their pharmacology. The student will attend PTX 631 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 733. Advanced Pharmacology IV - Endocrinology. 2 Hours.
A detailed study of the fundamentals of endocrinology and associated pharmacology. The student will attend PTX 633 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 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 pharmaceutical 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, cardiovascular 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.

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 775. 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 799. 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.