

Department of Pharmacology, Toxicology, and Therapeutics

Pharmacology and Toxicology together form a discipline that examines the interactions of chemical substances with living systems. Pharmacology focuses on the properties of drugs, including their sites of action, processing by the human body, and therapeutic uses. Toxicology studies the adverse effects of chemicals such as environmental agents and synthetic compounds, including drugs and their metabolites, and the means to prevent or treat their effects. Because the study of chemicals requires an intimate knowledge of the biological systems affected, Pharmacology and Toxicology are by necessity an integrative discipline that studies the effects of chemicals at the molecular, cellular, organ, organismal, and population levels.

Faculty members in the Department of Pharmacology, Toxicology & Therapeutics at KUMC have diverse research interests. These research topics are essential for developing new drugs and are fundamental to determining the safety of all chemicals. Thus, our students obtain a broad educational background that prepares them for a career in research and scholarly work in a variety of settings, including academia, the pharmaceutical or biotechnology industries, or governmental agencies. Our department faculty has an excellent record of training students, and our graduates have become scientific leaders in academia, government and industry.

During the last five years, the Department faculty has undergone major changes with the addition of several tenure-track and research-track faculty, with a major focus in liver pathobiology and toxicology. This was facilitated in part by a Center of Biomedical Research Excellence (COBRE) grant from the National Institutes of Health, and has been accompanied by major new equipment purchases. The Department is housed in state-of-the-art research space in the Hemenway Life Science Innovation Center. These resources provide an exciting environment that fosters personal and professional development in an atmosphere with ample opportunities for independent scholarship and strong collaborative activities.

Research opportunities are available for graduate students in the laboratories of faculty members throughout the department. Pharmacology faculty members have research interests in molecular and cellular neuropharmacology, neurotrauma, and the role of hormones and diet constituents on brain function. In addition, department faculty members study pharmacokinetics of drugs (absorption, distribution, biotransformation and excretion) and the biology and functional significance of drug transporters such as organic anion transporting polypeptides (OATPs), organic cation transporters (OCTs), and ATP binding cassette transporters. Our faculty members' research interests in Toxicology include the toxicity of environmental chemicals, mechanisms of drug- and chemical-induced hepatotoxicity (necrosis, apoptosis, autophagy, inflammation, fibrosis) and liver regeneration. Furthermore, they study the pathogenesis of hepatocellular carcinoma, alcoholic hepatitis, steatohepatitis and cholestatic liver disease, and the role of nuclear receptors in these disease processes. Likewise, in Therapeutics, faculty members use metabolomics approaches to study herbal medicines' ability to cause drug interactions with prescribed drugs.

In addition, studies are being performed to understand which drugs enter the liver by specific transporters, and how genetics determine why the response to drugs can vary between individual patients (pharmacogenomics).

Courses

PHCL 761. General Principles of Pharmacology. 1 Credits.

General principles of pharmacology, including pharmacokinetics, pharmacodynamics, adverse effects, pharmacotherapeutics plus miscellaneous agents (antacids, cathartics, biologicals). Open to advanced B.S. students and graduate students in Nursing, Allied Health, and other health related programs. Independent study program with use of computer assisted instruction, textbooks, syllabi, consultation with staff and exams as primary teaching instruments. Students are encouraged to complete this course the semester they enroll. If this course is not completed, students will receive an Incomplete grade. Prerequisite: An Enrollment Permission Form must be signed by the student and the instructor. In addition, the enrollment card must be stamped by the instructor.

PHCL 762. Pharmacology of the Autonomic Nervous System. 1 Credits.

General principles of the autonomic nervous system, cholinergics, muscarinics, nicotinic, neuromuscular blockers, beta adrenergics, alpha adrenergics, and miscellaneous ANS agents. Students are encouraged to complete this course the semester they enroll. If this course is not completed, students will receive an incomplete grade. Prerequisite: PHCL 761 and an Enrollment Permission Form must be signed by the student and the instructor. In addition, the enrollment card must be stamped by the instructor.

PHCL 763. Cardiovascular-Renal Pharmacology. 1 Credits.

Antihypertensives, antiarrhythmics, vasodilators, cardiac glycosides, serotonin, histamine, polypeptides, diuretics, antilipidemics. Students are encouraged to complete this course the semester they enroll. If this course is not completed, students will receive an incomplete grade. Prerequisite: PHCL 761 and an Enrollment Permission Form must be signed by the student and the instructor. In addition, the enrollment card must be stamped by the instructor.

PHCL 764. Pharmacology of the Central Nervous System. 1 Credits.

General principles of the central nervous system, stimulants, hallucinogens, depressants (hypnotics and sedatives), general and local anesthesia, antiparkinson agents, tranquilizers, analgesics and anticonvulsants. Students are encouraged to complete this course the semester they enroll. If this course is not completed, students will receive an Incomplete grade. Prerequisite: PHCL 761 and an Enrollment Permission Form must be signed by the student and the instructor. In addition, the enrollment card must be stamped by the instructor.

PHCL 765. Chemotherapy. 1 Credits.

Principles of chemotherapy, sulfonamides, penicillins, aminoglycosides, anticancer and antifungal agents, antimalarials, broad spectrum antibiotics, antiparasitic agents, and antiseptics. Students are encouraged to complete this course the semester they enroll. If this course is not completed, students will receive an Incomplete grade. Prerequisite: PHCL 761 and an Enrollment Permission Form must be signed by the student and the instructor. In addition, the enrollment card must be stamped by the instructor.

PHCL 766. Blood-Endocrine Pharmacology. 1 Credits.

General principles of endocrine function and use, thyroid drugs, insulin, sex hormones, oxytocics, adrenal steroids, antiinflammatory agents, blood drugs, anticoagulants and vitamins. Students are encouraged to complete

this course the semester they enroll. If this course is not completed, students will receive an incomplete grade. Prerequisite: PHCL 761 and an Enrollment Permission Form must be signed by the student and the instructor. In addition, the enrollment card must be stamped by the instructor.

PHCL 767. Toxicology. 1 Credits.

General principles of toxicology, clinical toxicology, solvents, metals, gases and dusts, corrosives, plant and animal toxins, pesticides, radiation, miscellaneous. Students are encouraged to complete this course the semester they enroll. If this course is not completed, students will receive an incomplete grade. Prerequisite: PHCL 761 and an Enrollment Permission Form must be signed by the student and the instructor. In addition, the enrollment card must be stamped by the instructor.

PHCL 809. Seminar in Pharmacology. 1 Credits.

Weekly meetings.

PHCL 846. Advanced Neuroscience. 5 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, PHSL 846, NURO 846 and NEUS 846.) Prerequisite: Permission of the course director.

PHCL 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, NURO 848, PHSL 848, and NEUS 848.) Prerequisite: Advanced Neuroscience (ANAT 846, PHCL 846 or PHSL 846) or an equivalent course and consent of instructor.

PHCL 875. Mitochondrial Biology (Form and function), Bioenergetics and Metabolism in human disease. 3 Credits.

This course is designed to explore mitochondrial physiology from perspectives of research, diagnostics, and clinic, from molecule, to man, to population. The course is an interactive program which goes beyond the textbook to actively engage the learner in current state-of-the-art laboratory and clinical practice. Starting from a basic introduction to cellular bioenergetics, the course focuses on the mitochondrial oxidative phosphorylation system, plasticity of mitochondrial structure/microscopy, mtDNA genetics, maintenance and gene expression, biogenesis of the oxphos system, protein dynamics, and drug development. The diagnostic sessions will highlight existing and novel genetic and biochemical diagnostic approaches with a special focus on the development of biomarkers for disease. During the clinical sessions the learner will be introduced to the clinical presentation of mitochondrial disorders, the personal perspective of the patient, anamnesis, clinical guidelines, case reports, treatment options, trials, and the development of outcome measures. As part of the course participants are expected to develop a translational mini-project in pairs of which the results are presented on the final course day. Prerequisite: Successful completion of the Interdisciplinary Program in Biomedical Sciences or permission of the Instructor.

PHCL 880. Essentials of Pharmacology. 4 Credits.

Introduction to Pharmacology for Graduate Students. Autonomic, Cardiovascular and Renal, Endocrine, Neuro, Antivirals Pharmacology. Autacoids; Workshop; Historical and Contemporary Methods used to Elucidate Mechanisms of Drug Action. Prerequisite: Successful

completion of the Interdisciplinary Program in Biomedical Sciences or permission of the Instructor.

PHCL 890. Research in Pharmacology. 1-10 Credits.

For graduate students beginning their research training.

PHCL 898. Principles of Pharmacology. 1 Credits.

Chemical fundamentals in structure, actions and metabolism of drugs and toxicants. Included are molecular features of drugs and toxicants, stereoisomerism, receptor theory, dose-response relationships, agonists and antagonists, absorption, pharmacokinetics and structure-activity relationships.

PHCL 899. Thesis in Pharmacology. 1-10 Credits.

For students in a master's program in pharmacology.

PHCL 924. Clinical Pharmacology. 5 Credits.

Designed to give practical and theoretical experience with drug trials in humans. Includes animal experimentation when warranted. Clinical principles of drug therapy will be emphasized.

PHCL 939. Carcinogenesis and Cancer Biology. 3 Credits.

Multidisciplinary approach. Cancer pathology. Mutagenesis, Genetics, Carcinogen metabolism. Signal Transduction, Apoptosis, Initiation and promotion. Tumor Immunology. Cell proliferation. Protooncogenes and suppressor genes. Hormonal carcinogenesis. Cancer epidemiology. Dietary and environmental causation and prevention. Cancer in various organ systems. (Same as PATH 939 and PTOX 939.) Prerequisite: Completion of one of the following: IGPBS modules 1-4 or equivalent or permission of instructor.

PHCL 990. Research for Dissertation in Pharmacology. 1-10 Credits.

Prerequisite: PHCL 890.

PHCL 999. Dissertation in Pharmacology. 1-10 Credits.

Prerequisite: Open to students of advanced standing enrolled in the doctoral program in Pharmacology.

Courses

PHRM 910. Research in Pharmacology. 4 Credits.

Selected research problems may be investigated under the direction of individual staff members. A description of current staff research projects is available from the department. Offered in modules I-XII. Prerequisite: Permission of department.

PHRM 911. Readings in Pharmacology. 2-10 Credits.

Selected topics for reading in advanced texts and original papers in pharmacology. A paper and Journal Club presentation of the selected topic are required. Offered in modules I-XII. Prerequisite: Permission of department.

PHRM 914. Advanced Pharmacology. 4 Credits.

Consultant rounds, poison control, immunopharmacology, and environmental health. Offered in modules II and III. Prerequisite: Consent of instructor.

Courses

PTOX 830. Introduction to Clinical and Translational Cancer Research. 3 Credits.

Instruct students in developmental steps used in translating a basic science experiment with clinical applications into a proof of concept application and human trial. Multidisciplinary approach; lectures from faculty in Pharmacology, KU Cancer Ctr, KUMCRI. Curriculum: Levels of evidence-clinical impact, Pre-Clinical modeling, In-Vitro studies & Animal models, Cancer Drug Development-pharmacokinetics & toxicity, Pre-Clinical Proof of Concept & FDA, Creating a Pilot Study, Biostatistics 101,

Phases of Clinical Trials, Data Collection, Support Staff, Regulatory and DSMBs, IRB and HIPPA, Funding Study: Grants & Parma, Advertising study & meeting accrual goals, Goals of Phase I study, Goals & Objectives of Phase II Efficacy study, Phase 3 Multicenter Study: Value of Numbers & Utilizing Cooperative Groups. Prerequisite: Completion of first 2 years of Med School or graduate school, or enrollment in MD/PhD program. Students no meeting one of these criteria will require permission from course instructor.

PTOX 887. Toxicologic Pathology. 4 Credits.

Introductory pathology course for graduate students preparing for a career in basic toxicology research. Topics to be presented and discussed include: cell injury, inflammation, repair and regeneration, immunopathology, neoplasia, tumor pathology, respiratory pathology, liver pathology, neuropathology, miscellaneous organ pathology, and lab animal clinical chemistry.

PTOX 889. Research in Toxicology. 1-10 Credits.

Introductory pathology course for planning on being research toxicologists. Topics to be presented and discussed: cell injury, inflammation, repair and regeneration, immunopath, neoplasia, tumor pathology, respiratory pathology, liver pathology, neuropathology, miscellaneous organ pathology, and lab animal clinical chemistry.

PTOX 898. Principles of Toxicology. 1 Credits.

Chemical fundamentals in structure, actions and metabolism of toxicants and drugs. Included are molecular features of toxicants and drugs, stereoisomerism, receptor theory, dose-response relationships, agonists and antagonists, absorption, pharmacokinetics, and structure-activity relationships.

PTOX 899. Thesis in Toxicology. 1-10 Credits.

For students in a master's program in toxicology.

PTOX 917. Disposition of Xenobiotics. 2 Credits.

Principles of absorption, biotransformation, and excretion of xenobiotics. Prerequisite: PHCL 888 or departmental permission.

PTOX 918. Toxicology. 4 Credits.

Selected topics in environmental, forensic, and industrial toxicology.

PTOX 939. Carcinogenesis and Cancer Biology. 3 Credits.

Multidisciplinary approach. Cancer pathology. Mutagenesis. Genetics. Carcinogen metabolism. Signal Transduction, Apoptosis. Initiation and promotion. Tumor immunology. Cell proliferation. Protooncogenes and suppressor genes. Hormonal carcinogenesis. Cancer epidemiology. Angiogenesis. Dietary and environmental causation and prevention. Cancer in various organ systems. (Same as PATH 939 and PHCL 939.) Prerequisite: Completion of one of the following: IGPBS modules 1-4 or equivalent or permission of instructor.

PTOX 940. Techniques in Industrial Toxicology. 2 Credits.

A unique course where students are exposed to and have practical experience in techniques used for risk-assessment of chemicals. The course is taught with extensive input by industrial toxicologists who use these techniques on a daily basis. This course is offered at a local industrial setting. Prerequisite: PHCL 888; PTOX 917, PTOX 918, and PTOX 938, or departmental permission.

PTOX 990. Research for Dissertation in Toxicology. 1-10 Credits.

Prerequisite: PTOX 889.

PTOX 999. Dissertation in Toxicology. 1-10 Credits.

Prerequisite: Open to students of advanced standing enrolled in the doctoral program in toxicology.