

# PHARMACOLOGY AND TOXICOLOGY (PHTX)

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## **PHTX 400. Drugs and Their Actions. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students with junior or senior standing, or permission of instructor. This course is a general survey of pharmacology and related disciplines. The basic principles of pharmacokinetics and pharmacodynamics are presented followed by discussions of neuropharmacology, including drugs for treating neurological disorders and drugs of abuse; immunopharmacology and drugs for pain management; systems pharmacology, including autonomic, cardiovascular, respiratory, renal and endocrine pharmacology; and drugs targeting infectious diseases and cancer chemotherapy. The course will also cover selected topics such as drug design and development, herbal medications and pharmacogenomics.

## **PHTX 535. Introduction to Toxicology. 4 Hours.**

Semester course; 4 lecture hours. 4 credits. The basic principles of toxicology and toxicological evaluations; correlations of toxicological responses with biochemical, functional and morphological changes; environmental (including occupational and public health), forensic and regulatory concerns; and risk assessment and management are presented for graduate students in the biomedical sciences.

## **PHTX 548. Drug Dependence. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students with graduate or post-baccalaureate standing or with permission of instructor. This pharmacology course will focus on the neurochemical and molecular adaptations in the brain that contribute to drug abuse. The course will provide an overview of neurobiology, pharmacology, and human and animal methods to study drug use and major drugs with dependence liability, as well as covering special topics in drug dependence. Students will become familiar with evidence supporting addiction theory and mechanisms of drug action and will have the opportunity to apply this knowledge to consider public policies as they relate to drugs of abuse.

## **PHTX 597. Introduction to Pharmacological Research. 1-12 Hours.**

Semester course; 1-12 credits. Prerequisite: permission of instructor. Rotation research in pharmacology and toxicology laboratories for beginning graduate students.

## **PHTX 606. Introduction to Pharmacology of Therapeutic Agents. 1 Hour.**

Module course; 1 lecture hour. 1 credit. The basic principles of pharmacology and an in-depth consideration of the biodisposition and mechanisms of action of these agents. Drugs acting on the autonomic system are covered.

## **PHTX 614. Foundation in Psychoneuroimmunology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: at least one graduate-level course in immunocompetence, pharmacology, physiology, immunology, biochemistry or psychology, or permission of instructor. This course will provide an in-depth overview of how brain and immune systems interact to maintain physiological and biochemical steady-states essential to wellness. Theory and research drawn from neuroscience, immunology and psychology will be examined as a foundation for understanding mind-body relationships. Beginning at the cellular level, fundamental information underlying mutually interact neuroendocrine-immune system functions will be synthesized to inform an understanding of wellness as well as a variety of pathophysiological states related to the stress process.

## **PHTX 620. Ion Channels in Membranes. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Previous course work including basic concepts in electrophysiology, such as those covered in PHIS 501 or PHTX/PHIS/ANAT 509, is highly recommended. Detailed presentation of the fundamental biophysical properties of ionic channels in membranes including the elementary properties of pores, molecular mechanisms of ionic selectivity, mechanisms of drug block, structure-function relationships, and basis for channel gating. Discussion will encompass modern techniques for studying ion channel function. Crosslisted as: PHIS 620.

## **PHTX 625. Cell Signaling and Growth Control. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHTX 536 or consent of instructor. Covers biochemical and molecular biology approaches to pharmacological problems. Emphasizes signal transduction, oncogenes, protein kinases, stress responses and the control of cellular proliferation.

## **PHTX 630. Basic Concepts in Pharmacology for Graduate Students. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOC 503 or permission of instructor. This course provides basis for drug-receptor theory, quantitative understanding of drug-receptor interaction, drug-receptor-based signaling, in-vivo application of drug-receptor theory, pharmacokinetics and statistical treatment of drug-receptor interaction in pharmacology and toxicology.

## **PHTX 631. Virtual Pharmacology Lab. 1 Hour.**

Semester course; 1 laboratory hour. 1 credit. Corequisite: PHTX 630. Enrollment is restricted to graduate students. The goal of the course is to offer experience in pharmacology skills related to the design, conduct and interpretation of pharmacology research. The course will also include special topic discussions on emerging techniques and opportunities to discuss rotation research results. Graded as pass/fail.

## **PHTX 632. Neurochemical Pharmacology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHTX 630, PHTX 636, BIOC 503, BIOC 504, NEUS 609 or MEDC 555, or permission of instructor. Course focuses on neurotransmitters, transporters, receptors and intracellular signaling pathways that mediate chemical neurotransmission in the nervous system, with a secondary focus on the role of these neurochemical systems as pharmacological targets. Students attend lectures, read assigned scientific research articles, and present and critique these articles in class (2-3 presentations per student per semester). Students will also compose a final original perspective-type review paper based on a topic related to the course content, and give a final presentation based on their paper. Grading is determined by student presentations, an original final scientific review paper and participation in class discussions.

## **PHTX 633. Behavioral Pharmacology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This is a survey course covering research on the effects of drugs on behavior -- ranging from classical to operant conditioning behaviors. Additional topics will include drug self-administration, drug discrimination, unconditioned and conditioned drug effects, and behavioral toxicology. The course focuses primarily on laboratory research in animals although human research will also be covered. The relevance of this research literature to drug treatment of mental health disorders such as substance use disorders and pain will be discussed.

**PHTX 636. Principles of Pharmacology. 5 Hours.**

Semester course; 5 lecture hours. 5 credits. Prerequisite: PHTX 630 or permission of instructor and graduate program director. Corequisite: PHTX 639. A comprehensive course in pharmacology for graduate students. The mechanisms of action of major classes of pharmacologically active agents and basic principles of pharmacology are discussed. Topics include autonomic and cardiovascular pharmacology; CNS pharmacology; pharmacology of antimicrobials and cancer; gastrointestinal and endocrine pharmacology.

**PHTX 638. Cellular Mechanisms of Toxicology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: PHTX 536 or permission of instructor. A holistic approach is taken to describe and analyze toxicological information. Intact animal, organ, cellular, and biochemical responses to toxic agents are presented. Immunologic, genetic, endocrine, and central nervous system paradigms and their relationship to the mechanism of action of toxic agents as well as the predictive value of tests of these systems are presented. Kinetics and metabolism of toxic agents as well as statistical and analytical procedures are integrated into the discussions.

**PHTX 639. Principles of Pharmacology Journal Club. 1 Hour.**

Semester course; 1 lecture hour. 1 credit. Prerequisite: PHTX 630 or permission of instructor. Corequisite: PHTX 636. This course will be in journal club format run in parallel with PHTX 636. Journal club articles pertaining to drug classes and their mechanism of action will be presented by students. Topics include autonomic, CNS, endocrine, cardiovascular and cancer pharmacology.

**PHTX 640. Pharmacology of Analgesics. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: PHTX 630 and PHTX 636 or permission of the instructor. The course will be divided into three sections. In the first, students will review methods for measurement of pain and analgesia in humans and animals and describe the implications of these measures for translational pain research. In the second section, students will review the neurobiology of pain, with a focus on neural systems that mediate sensory and affective dimensions of pain and their modulation by endogenous pain inhibitory systems. In the final section, students will review the pharmacology of existing classes of drugs and the research strategies for evaluation of new candidate analgesics. Throughout the class, readings and discussions will consider both seminal literature and recent research papers.

**PHTX 641. Introduction to Clinical Pharmacology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students who have completed a post-baccalaureate degree or an undergraduate physiology degree or by permission of the instructor. This course is a general survey of clinical pharmacology designed for students pursuing professional degrees including dental, medical and pharmacy programs. The basic principles of pharmacokinetics, pharmacodynamics and pharmacogenetics are presented followed by discussions of neuropharmacology, including drugs for treating neurological disorders and drugs of abuse; immunopharmacology and drugs for pain management; systems pharmacology including autonomic, cardiovascular, respiratory, renal, GI and endocrine pharmacology; and drugs targeting infectious diseases and cancer chemotherapy.

**PHTX 690. Pharmacology Research Seminar. 1 Hour.**

Semester course; 1 lecture hour. 1 credit. Members of the departmental staff, students, and visiting lecturers participate in discussions on topics of current and historical interest.

**PHTX 691. Special Topics in Pharmacology. 1-4 Hours.**

Semester course; 1-4 credits. Prerequisite: permission of instructor. Special topics in pharmacology or toxicology covered in less detail in other courses will be studied in depth in this course.

**PHTX 692. Special Topics. 1-4 Hours.**

Semester course; 1-4 variable hours. 1-4 credits. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of the research training. Graded as S/U/F.

**PHTX 697. Directed Research in Pharmacology. 1-15 Hours.**

Semester course; 1-15 credits. Research leading to the M.S. or Ph.D. degree and elective projects for other students.