PHARMACOLOGY (PH.D.)

Admission is contingent upon admission to the Graduate School (http://bulletins.wayne.edu/graduate/general-information/admission/) and the graduate programs of the School of Medicine (http://bulletins.wayne.edu/graduate/school-medicine/programs/), respectively. Applicants to the graduate program of the Department of Pharmacology should have a background in one of the chemical or biological sciences. Students with diverse backgrounds will be considered individually if they have special competence related to one of the departmental areas of interest. Applicants are expected to provide scores from the Graduate Record Examination. A subject test is not required, but is helpful in making the admission decision. Personal interviews are recommended. Letters of inquiry should be directed to the Chair, Graduate Admissions Committee of the Department.

Ph.D. students in the graduate program in pharmacology enroll in the School of Medicine's Interdisciplinary Biomedical Sciences (IBS) curriculum during their first year. The IBS curriculum includes:

Code	Title	Credits
IBS 7015	Interdisciplinary Cell and Molecular Biology	6
Selection by the student in conjunction with the departmental Graduate Officer of courses within the IBS Systems curriculum:		
IBS 7030	Functional Genomics and Systems Biology	2
IBS 7050	Molecular Neuropsychopharmacology	2
IBS 7090	Fundamentals of Immunology	2
IBS 7100	Biomedical Neuropharmacology	2
IBS 7130	Systems Neuroscience: Structure and Function of the Nervous System	2
IBS 7140	Foundations of Data Science	3
Total Credits		**19**

Pharmacology course requirements include: Pharmacology lecture (PHC 7010) (successful completion of this course will provide a waiver of two credits of Systems Biology coursework), participation in the journal club (PHC 7700) and seminar series (PHC 7890), and the selection of six advanced pharmacology minicourses (PHC 7650).

For each student in the program a unique plan is constructed to allow utilization of previous educational experience and individual interests, permitting the student to progress as rapidly as possible. The program consists of a small number of required courses, several research rotation projects, a qualifying examination, and a doctoral dissertation based on new and significant research findings. The research opportunities available for graduate students include the areas of biochemical, cellular, and renal pharmacology; neuropharmacology; cancer biology, including therapeutic approaches; drug metabolism; and environmental toxicology. Major expertise is available in the cell biology of protein trafficking and signal transduction, in protein chemistry, proteases and molecular biology, cellular aging, and in functional imaging technology. A concentration in molecular neuropharmacology is available for specialized training in pharmacology as applied to neuroscience. The master's degree requires the successful completion of a thesis based on original laboratory research. The thirty-credit Ph.D. dissertation registration requirement is fulfilled by registration in the coursesPHC 9991,PHC 9992,PHC 9993, andPHC 9994(Doctoral Dissertation Research and Direction I, II, III, and IV, respectively), in consecutive academic year semesters.

All course work must be completed in accordance with the regulations of the Graduate School (http://bulletins.wayne.edu/graduate/general-information/academic-regulations/) and the School of Medicine (http://bulletins.wayne.edu/graduate/school-medicine/programs/) governing graduate scholarship and degrees.

Molecular and Environmental Toxicology Concentration: The MET concentration fulfills the basic requirements for a Ph.D. in Pharmacology but also entails additional toxicology-related classroom and research experience. The disciplines of pharmacology and toxicology are highly intertwined. They require the same basic knowledge set; involve the study of the same biochemical, molecular and genetic processes; and use a similar vocabulary. However, the focus of the two disciplines is different, with pharmacology being concerned with the therapeutic effects of drugs and toxicology being concerned with the detrimental effects of chemicals and agents on biological processes. The term "environmental" is used in the concentration's title to convey the concentration's attention to the effects of environmental exposure on human health, as opposed to ecological/terrestrial effects. The overall goals of the MET concentration are to provide comprehensive instruction in modern-era molecular and cellular toxicology, and an appreciation of how such expertise can be used not only to study the mechanism of an agent's toxic effects, but also in an interdisciplinary fashion to study environmentally-linked disease. To achieve this goal, the MET concentration will offer interdisciplinary research opportunities and access to mentors who are dedicated to understanding the toxic effects of specific toxicants (environmental and therapeutic), as well as probing the complex effects of exposure to environmental stressors. Available research projects in the MET concentration will feature investigations examining the effects of environmental agents (e.g., urban air pollution, cigarette smoke, PCBs, lead, dioxin, and phthalates) on cellular and molecular processes involved in disease susceptibility, and initiation and progression. MET scientists are studying intracellular signaling pathways, transcriptional regulation of gene expression, apoptosis, oxidative stress, DNA repair, epigenetic and genetic perturbations, and complex mechanisms in cell growth and differentiation that determine the environmental contribution to diseases with a rising incidence in the urban setting such as metabolic disease, cancer, immune system disturbances, and mental health disorders.

The MET concentration in the Department of Pharmacology Graduate Program emphasizes the use of contemporary approaches, such as advanced techniques in biochemistry, cell biology, molecular biology, molecular genomics, epigenetics, bioinformatics, proteomics, and epidemiology, in problems aimed at dissecting the mechanisms of environmentally-induced disease. In order to prepare for challenging careers in academics, industry, and government, students in the MET concentration are expected to seek access to research laboratories that conform to standards of excellence and are recognized by peers to be competitive in the environmental health sciences/molecular and cellular toxicology field. It is the goal of the MET concentration to prepare our students of today to serve as the leaders of tomorrow.

Molecular Neuropharmacology Concentration: The doctoral program in Pharmacology includes a concentration in molecular neuropharmacology. The focus of this concentration is to provide training in the molecular aspects of neuropharmacology, with an emphasis on molecular signaling and functional genomics. The Department recruits competitive, highly motivated graduate students for training in this unique and topical discipline.

Pharmacologists, by the very nature of their discipline, determine the response of individual cells, tissues and/or organisms to changes in the internal and external environment (including therapeutic agents) and are thus in increasing demand in the 'post-genomic' era. Neuropharmacologists are especially in demand, given both the need for current therapeutic drugs for CNS disorders and the rapid pace of discovery about basic neural mechanisms that shows much promise for therapeutic purposes. Biomedical scientists are now acutely aware that there is, in fact, not a single human genome but myriad genomes

comprised of countless DNA deletions, insertions, and single nucleotide polymorphisms which change the substrate upon which environmental factors act and also modify the human response to therapeutic drugs. Neuropharmacology, in the post-genome era, thus encompasses both the effects of drugs on neural cell function as well as the influence of genetic variations (from SNPs to gene knockouts) on drug responses at the cellular and organismic level. In this context, the application of molecular and genetic tools provides critical insights into brain function and facilitates the development of novel therapeutics for brain dysfunction and tumors.