

Master of Science in Pharmacology

Program code: 055010

INTRODUCTION

The Department of Pharmacology & Toxicology (Faculty of Medicine) offers a Master of Science Program in **Pharmacology**. The program, which is thesis based, aims at providing a sound understanding of the theoretical and practical aspects of the action of drugs as the basis of therapeutics. Basic course in Pharmacology are followed by advanced courses in the core areas of the discipline such as Cardiovascular, Molecular, Neuro-endocrine, Biochemical/Toxicology and Immunopharmacology. These areas also represent the key areas of research interest of the Departmental academic staff. Research requirements include only thesis option.

According to the University Council decision dated 4/2/2007, Thesis students admitted with effect from September 2007 are exempted from the comprehensive examination.

PROGRAM REQUIREMENTS

38 TOTAL COURSE CREDITS

26 COMPLUSORY COURSES (Credits in parenthesis)

0510-501	Biostatistics and Computer in Medicine	(2)
0520-538	Basic Immunology	(1)
0540-521	Basic Molecular Biology	(1)
0550-500	Principles of Pharmacology I	(3)
0550-501	Principles of Pharmacology II	(3)
0550-504	Experimental Techniques	(3)
0550-505	Molecular Pharmacology	(2)
0550-516	Seminar in Pharmacology	(1)
0550-519	Advanced Topics in Pharmacology I	(3)
0550-520	Advanced Topics in Pharmacology II	(2)
2000-501	Scientific Writing and Communication Skills	(3)
2000-503	Ethics and Professionalism	(2)

3 ELECTIVE COURSES

The remaining 3 credit hours may be selected only from the following courses offered by the Department of Pharmacology or other departments in the Faculty of Medicine, with the approval of Program Director.

0530-566	Neurophysiology	(3)
0540-564	Biochemistry of Diseases	(3)
0550-521	Autonomic and Smooth Muscle Pharmacology	(2)
0555-505	Radiobiology & Radiation Protection	(1)
0570-501	Biology of Diseases	(3)

9 COMPULSORY COURSES

0550-597	Thesis	(0)
0550-598	Thesis	(0)
2000-599	Thesis	(9)

COURSE DESCRIPTION

**0550-500: PRINCIPLES OF
PHARMACOLOGY I
CR: 3**

This course presents the general principles of drug action including aspects of drug-receptor interaction, absorption, fate, interactions and side effects of major therapeutic substances. Advanced aspects of these topics are covered by directed reading and tutorials.

**0550-501: PRINCIPLES OF
PHARMACOLOGY II
CR: 3**

In this course the pharmacological basis of therapeutics is dealt with in depth and the major groups of drugs, i.e., cardiovascular, renal, chemotherapeutic, and agents affecting the autonomic and central nervous systems will be described. Therapeutic principles are explained by attention to the pathophysiology relevant to that drug group. Advanced material is covered by directed reading and seminars.

**0550-504: EXPERIMENTAL TECHNIQUES
CR: 3**

This course provides basic training in the following: Solutions: Drug and physiological solutions, drug concentrations, preparation and storage of drugs. experimental animals: Handling of animals, anaesthesia and surgery, routes of administration, artificial respiration. Bioassay: Principles of measuring muscle contractions, isotonic, isometric, auxotonic; recording blood pressure. Behavioral techniques: Animal activity meters, stereo tactic surgery. Recording techniques: Electronic Recording systems. Laboratory reports: Recording of results and experimental data. Management and handling of laboratory equipment. Analytical techniques: Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC), Gas Chromatography-

Mass-Spectrometry (GC-MS), Molecular biology Techniques.

**0550-505: MOLECULAR PHARMACOLOGY
CR: 2 PR: 0500-501**

The course deals with the molecular characterization of interactions between drug molecules and receptors or other macromolecular targets in cells, as well as how chemical structure correlates with biological activity. It also deals with how cells receive, transmit and respond to external signals from hormones, transmitters and pharmacological agents, and how molecular biology techniques are utilized to study these events. The first part of the course introduces students to the latest advances in molecular pharmacology, namely pharmacogenomics, bioinformatics, proteomics, micro-array technology, gene silencing technology and their applications in pharmacological research. Subsequently, the course deals with the classical aspects of receptor pharmacology, including theories of drug-receptor interactions, measurement of agonist dissociation constant, and receptor antagonism. Other areas covered include various signal transduction pathways, identification of signaling molecules as drug targets and the principles of drug design and development. Modes of delivery will include traditional lectures, linked tutorials based on published papers, as well as presentations by students of relevant topics. The course builds on information presented in the course "Basic Molecular Biology" which is its pre-requisite.

**0550-516: SEMINAR IN PHARMACOLOGY
CR: 1**

Current literature topics in Pharmacology. This is an advanced course for second year graduate students in Pharmacology.

**0550-519: ADVANCED TOPICS IN
PHARMACOLOGY I
CR: 3**

This course covers important topics from three areas of Pharmacology, namely the Cardiovascular, Neuro and Endocrine areas. Within each area teaching will take an integrated approach and where possible integration across the systems or areas will also be undertaken. This course will build on, and deal with the advanced aspects of, the materials already covered in the Principles of Pharmacology I & II (500 & 501) courses. In the Cardiovascular section, topics to be covered include the physiology of the heart and the vascular systems, pathophysiology and drug treatment of a number of cardiovascular disease states, including hypertension, heart failure, hyperlipidaemias and angina pectoris. Novel and potential therapeutic targets as well as pharmacogenomic approaches to the identification of new targets will be discussed. The endocrine component will cover the hormones of the anterior pituitary, the feedback control mechanisms of hormone secretion, pharmacology of insulin and insulin resistance as well as the thyroid and anti-thyroid drugs. The Neuropharmacology section will cover central and peripheral pain systems and their control, opioid and non-opioid analgesics, anti-psychotics and antidepressants as well as anti-Parkinson drugs.

**0550-520: ADVANCED TOPICS IN
PHARMACOLOGY II
CR: 2 PR: 0500-502**

This course covers important topics from two areas of Pharmacology, namely Immunopharmacology and Biochemical Pharmacology / Toxicology. Within each area teaching will take an integrated approach and where possible integration across sections will be undertaken. This course will build on, and deal with the advanced aspects of, the materials already covered in "Basic Immunology" as well as in Principles of Pharmacology I & II (500 & 501) courses. The Immunopharmacology section of the course will cover areas such as pathogenesis of allergic reactions, mechanisms of mediator release and signal transduction pathways, principles of drug allergy, drug therapy of allergic diseases, pathophysiology of asthma and drug therapy. Others will include mechanisms and drug therapy of autoimmune diseases and chronic inflammatory diseases, graft rejection and immunosuppressive agents. The second part will cover basic principles of biochemical toxicology, role of drug metabolism in drug toxicity, target

organ toxicity, toxic effects of reactive oxygen species, cell necrosis and apoptosis, mutagenesis and carcinogenesis, developmental toxicology, applications of toxicology, basic principles in the treatment of acute poisoning, poisoning with common drug groups, alcohols, environmental toxins, principles of therapeutic drug monitoring, toxicological screening in clinical toxicology.

**0550-521: AUTONOMIC AND SMOOTH
MUSCLE PHARMACOLOGY
CR: 2**

The first part of this course will deal with innervation of smooth muscles with emphasis on autonomic and peptidergic nerves. This will be followed by the discussion of receptors activated by neurotransmitters released by these nerves. In the second part of the course, emphasis will be on the role of signaling mechanisms involving ion channels (calcium and potassium channels, protein kinase C, tyrosine kinase and mitogen activated protein kinases (ERK, p38 MAPK and JNK), AMP and cGMP in the regulation of smooth muscle tone and agonist-induced contraction and relaxation of smooth muscles. The role of Ca²⁺ sensitization (and the RhoA/Rho kinase pathway) in smooth muscle contraction will be discussed. Finally the relevance of these processes to the pathogenesis of some cardiovascular and non-cardiovascular diseases will be discussed.

**0550-597: THESIS
CR: 0**

**0550-598: THESIS
CR: 0**

**2000-599: THESIS
CR: 9**