

# MOLECULAR AND CELLULAR PHARMACOLOGY (MCP)

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**MCP 701. Seminar. 2 Credit Hours.**

Review of related literature, discussion of special topics, student presentations and attendance of faculty/department seminars. Course may be repeated for a total of eight credits.

**Components:** SEM.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**MCP 704. Mechanisms of Drug Action. 3 Credit Hours.**

This course focuses on a basic scientific understanding of the main processes underlying drug action. It briefly covers all important aspects of both the pharmacodynamic and pharmacokinetic phases including (i) a review of the receptor concept and related general principles; (ii) a detailed discussion of quantitative models of receptor occupancy, agonism, and antagonism; (iii) basic concepts related to absorption, distribution, metabolism, and elimination (ADME) processes and pharmacokinetics; (iv) illustrative molecular mechanisms of action for a few representative drug classes; and (v) an overview of the drug design and discovery process

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**MCP 731. Special Topics. 1-6 Credit Hours.**

Directed readings on subjects not ordinarily treated in depth in specific courses. Course may also consist of special laboratory problems.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**MCP 732. Cardiovascular Pharmacology. 2-3 Credit Hours.**

The course covers cardiovascular pharmacology, necessary cardiovascular physiology and anatomy and the function and pharmacology of the autonomic nervous system. The students learn about the function and energetics of the heart and how it is changed in cardiac disease.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall Even Years.

**MCP 733. Research & Development in Pharmacology. 1-6 Credit Hours.**

Presentations are a huge part of scientific life. They are very important for advancing students' careers. Furthermore, a presentation (verbal or written) is the only way you can let others know about your results. This ability will be earned by observing and discussing seminar presentations given by faculty and fellow students, and by practicing your own scientific presentation and receiving feedback from the instructors and other students. Draft your individual development plans (IDP) for successful graduate training and career. The class will discuss the significance and the basic elements of an individual development plan. Discuss important issues of Responsible Conduct of Research and Professionalism. Responsible conduct of research (RCR) is the practice of scientific investigation with integrity and is an important component of your research training. It involves the awareness and application of established professional norms and ethical principles in the performance of all activities related to scientific research. In MCP731, we actively incorporate the RCR education in the seminar series by using real-life materials and situations as examples for in-depth analyses and discussions, in addition to other teaching materials as recommended by the relevant NIH guidelines. By these mechanisms, the MCP731 will cover all the RCR issues as recommended by the NIH guidelines with a focus on topics related to pharmacological sciences.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**MCP 743. Introductory Python Programming for Bioscientists. 3 Credit Hours.**

This course is designed to teach problem solving using the Python programming language. No prior programming knowledge is needed. Students will learn to write their own original Python programs to parse, manipulate, and analyze big data sets containing genomic, proteomic, and structural information. As the course progresses, students will be encouraged to apply their emerging programming knowledge to tackle scientific problems of their interest. The course culminates with each student designing a final project related to their research. This is a hands-on course with in-class interactive programming. Therefore, students are required to have their own Mac or PC laptop in good working condition for every class.

**Components:** DIS.

**Grading:** SUS.

**Typically Offered:** Spring.

**MCP 752. Systems Biology and Approaches in Pharmacology. 2 Credit Hours.**

In this course students will discuss the biochemical structure and function of signaling pathways that are most frequently targeted by the pharmaceutical industry. Students will be exposed to novel concepts and findings, in particular with regards to innovative therapeutic applications. Each week will address a different pathway or signaling network, its biological targets and functions, and specific drugs that target it. Each week includes one lecture and one class where students and instructor convene to discuss articles, technical approaches or fundamental questions in the field.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**MCP 753. Computational Pharmacology and Fundamentals of Drug Design. 2 Credit Hours.**

In pharmacology, the importance of computation and bio- and chemo-informatics cannot be overestimated. This course is collectively taught by the MCP faculty and addresses the following four distinct areas. (1) Computer-based analysis of drug-receptor interactions. Students learn principles and specific software packages for in silico docking of drugs to proteins, predict structure-activity relationships and become familiar with programming tools required for such tasks. (2) Using on-line databases to study biological activity, therapeutic indexes, toxicity and other characteristics of drugs and other chemicals. Similarly, they learn to analyze the vast information available for drug targets such as receptor proteins and enzymes. (3) Students learn about pharmacogenomics, an area essential for personalized medicine. Here, they learn, for example, how to predict the reaction of certain populations to particular treatments. (4) Students learn about the drug development pipeline, starting with the design, through screening chemical libraries and to the basics of FDA approval.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**MCP 754. Identification and validation of pharmacological targets. 2 Credit Hours.**

Pharmacological treatment of many diseases is based on inhibiting or stimulating certain enzymes, receptors, and channels, generally referred to as "drug targets." Pathological events can be triggered by mutations, changes in gene expression, and activity of various proteins. The crucial step in devising a therapeutic strategy is to decide which target to select for manipulation by a pharmacological agent. What makes a target successful, i.e. amenable to pharmacological intervention? How does one discover and validate such a novel drug target? This course will analyze examples of cellular pathways that have been successfully targeted by FDA-approved drugs or are currently under investigation. The classes are taught by several MCP faculty who are experts in signal transduction, gene expression, cell proliferation, cancer biology, and other cellular processes. One important aspect of this class is that the students will learn to apply general principles of target identification and validation to their areas of interest and/or ongoing research projects in their labs. The knowledge gained from the lectures and critical discussions in this course will help students design their dissertation research and aid in their future careers.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**MCP 755. Strategies and methodologies of modern drug discovery campaigns. 2 Credit Hours.**

This course will address the current state of the art in general principles, technologies, and available resources used in the process of drug discovery. It will be taught collectively by MCP faculty who have expertise and are currently involved in drug discovery projects. The presentations and faculty-led discussions will cover topics such as assay development, the criteria for suitability of an assay for high-throughput screening (HTS), and the necessary controls to validate the "hits." Pharmacological characterization of novel compounds (EC50, stability, toxicity, etc.) will also be covered. Students will also learn about the fundamentals of the current in silico drug design methods and virtual screening based on the structure of the protein target and structure-activity relationships (SAR) in the ligands. In addition to traditional small molecule chemicals, the faculty will also discuss other types of therapeutics, such as engineered growth factors, gene therapy agents, and innovative approaches like targeted protein degradation. The technical knowledge about the principles of the drug discovery "pipeline" will be complemented with relevant economic, translational, and regulatory aspects. In this class, students will propose designing a drug (a small molecule or biological agent) discovery project applied to their area of interest.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**MCP 768. Neuropharmacology. 2-3 Credit Hours.**

An intensive course covering the regulation of neural processes by drugs that target neurotransmitter signaling at the level of GPCRs, G proteins, second-messengers and ion channels.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall Odd Years.

**MCP 810. Master's Thesis. 1-6 Credit Hours.**

The student working on his/her master's thesis enrolls for credit, in most departments not to exceed six, as determined by his/her advisor. Credit is not awarded until the thesis has been accepted.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**MCP 820. Research in Residence. 1 Credit Hour.**

Used to establish research in residence for the thesis for the master's degree after the student has enrolled for the permissible cumulative total in MCP 710 (usually six credits). Credit not granted. May be regarded as full time residence.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**MCP 830. Dissertation Research-Pre-Candidacy. 1-12 Credit Hours.**

Required for all PhD candidates. The student will enroll for credits as determined by their advisor/Office of Graduate and Postdoctoral Studies. No more than 12 hours of research may be taken in a regular semester, and no more than six in a summer session.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**MCP 840. Doctoral Dissertation- Post Candidacy. 1-12 Credit Hours.**

Required for all PhD candidates. The student will enroll for credits as determined by their advisor/ Office of Graduate and Postdoctoral Studies but not less than a total of 24. No more than 12 hours of research may be taken in a regular semester, and no more than six in a summer session.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**MCP 850. Research in Residence. 1-12 Credit Hours.**

Student must be registered in the semester they plan to defend. Used to establish research in residence for the PhD after the student has been enrolled for the permissible cumulative total in appropriate doctoral research. Student may be regarded as full-time residence as determined by the Dean of the Graduate School.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.