

Department of Medicinal Chemistry

Medicinal Chemistry Graduate Programs

Medicinal chemistry is an interdisciplinary field at the interface of chemistry and biology. It approaches important biological and health-related problems through application of fundamental principles of organic chemistry, biochemistry, natural product chemistry, and molecular pharmacology. Graduates are expected to be thoroughly familiar with the chemistry of organic compounds, including their synthesis and biosynthesis, their reactivity, and their interactions with and alteration by living systems. Research is at the heart of the program, and the department's research activities encompass many areas of modern medicinal chemistry.

Currently, the department has 10 full-time faculty members, about 25 graduate students, more than 20 postdoctoral associates, numerous undergraduate researchers, and an outstanding technical staff. The department is recognized nationally and internationally, and most graduates have gone on to successful careers in the pharmaceutical industry and in academia. Medicinal chemistry faculty members are directors of two Centers for Biomedical Research Excellence (COBRE) — Protein Structure and Function (<http://psf.cobre.ku.edu>) — as well as the Center for Chemical Biology of Infectious Diseases (<http://cbid.cobre.ku.edu>), both funded by the National Institutes of Health.

Facilities

The department is well equipped for both chemical and biochemical research and has research facilities for about 60 graduate students, postdoctoral associates, and research technicians. Malott Hall, where part of the medicinal chemistry laboratories are located, also houses the department of Pharmacology and Toxicology (<http://www.pharmtox.pharm.ku.edu>). Anschutz Library is adjacent to the building. Much of the laboratory space in the department has undergone renovation and provides research laboratories for chemical synthesis and biochemical research. Faculty are also housed in several modern research buildings on west campus (Shankel Structural Biology Center) and main campus (Integrated Science Building). The department has an excellent complement of modern spectroscopic, biochemical, and chromatographic instrumentation, and other specialized research instrumentation is available through cooperative arrangements with other departments.

Advanced instrumentation and facilities are available through KU's Molecular Structures Group (<http://msg.dept.ku.edu/webs/msg>) (MSG). MSG laboratories include the Biochemical Research Service Laboratory (BRSL), the Mass Spectrometry Laboratory, the Nuclear Magnetic Resonance Laboratory, the Molecular Graphics and Modeling Laboratory, the X-ray Crystallography Laboratory, and the Protein Structure Laboratory (dedicated to macromolecular X-ray crystallography) with more than \$10 million in instrumentation.

The Shankel Structural Biology Center (SBC) offers new research opportunities for medicinal chemists interested in protein and nucleic acid structure and combinatorial synthesis; it also houses a 800-MHz NMR. The Analytical Proteomics Laboratory, which combines activities of the Mass Spectrometry Lab and BRSL to create a collaborative environment for protein handling, protein mass spectrometry, and bioinformatics, is in SBC. In the same building, the High Throughput Screening Laboratory

(<http://www.hts.ku.edu>) has integrated and automated robotics equipment for carrying out biochemical and cell-based assays and a chemical library of more than 100,000 compounds with diverse structures and drug-like properties for biological screening. The service laboratories have professional staff that provides training in specialized research techniques in addition to their service functions.

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Courses

MDCM 601. Medicinal Biochemistry I. 3 Hours.

A study of the biochemical principles of macromolecular structure and function, molecular communication, and the metabolism of nutrients and xenobiotics as applied to problems of medicinal and pharmacological significance. LEC.

MDCM 603. Medicinal Biochemistry II. 3 Hours.

A study of the biochemical principles of macromolecular structure and function, biosynthesis, molecular communication, and the metabolism of nutrients and xenobiotics as applied to problems of medicinal and pharmacological significance. Prerequisite: MDCM 601. LEC.

MDCM 606. Phytomedicinal Agents. 1 Hour.

This course will acquaint the pharmacy students with the current status of botanical use in the United States. A basic foundation will be provided so that the pharmacist can properly assess the appropriateness and usefulness of various phytomedicines and combinations in managing certain ailments with regard to efficacy, safety, potential toxicity, and potential herb-drug interactions. Prerequisite: MDCM 601 or instructor permission. LEC.

MDCM 607. Clinical Pharmacognosy. 1 Hour.

The course will provide a technical background for understanding the scientific basis underlying the use of herbal medicines. This will be followed by practical information about the pharmacological and chemical properties as well as clinical uses of herbal medicines. Active student participation in discussing the properties of these non-prescription medicinals is expected. Prerequisite: MDCM 601 or instructor consent. LEC.

MDCM 625. Medicinal Chemistry I: Neuroeffector and Cardiovascular Agents. 4 Hours.

A study, from the molecular viewpoint, of the organic substances used as medicinal agents, including consideration of their origins, chemical properties, structure-activity relationships, metabolism and mechanisms of action; this course emphasizes drugs affecting the cardiovascular and central nervous systems. Prerequisite: CHEM 626 and MDCM 601. LEC.

MDCM 626. Medicinal Chemistry II: Homeostatic Agents. 4 Hours.

A continuation of MDCM 625 with special emphasis on anticancer, antiviral, antibacterial, antifungal, antidiabetic, anticholesterol, and steroidal drugs. Prerequisite: MDCM 625. LEC.

MDCM 690. Undergraduate Research. 1-5 Hours.

Research in medicinal chemistry. Students will be assigned to a laboratory research problem. Prerequisite: Consent of instructor. IND.

MDCM 692. Problems in Medicinal Chemistry. 1-5 Hours.

This course encompasses original work on a laboratory problem of limited scope, honors reading assignments from medicinal chemistry literature, or in-depth discussions of assigned topics. Prerequisite: Consent of instructor. IND.

MDCM 701. Advanced Medicinal Biochemistry I. 3 Hours.

A study of the principles of macromolecular structure and function, biosignaling, bioenergetics and metabolism, with an emphasis on the relationship between biochemistry and medicine. Prerequisite: Graduate standing or permission of instructor. LEC.

MDCM 703. Advanced Medicinal Biochemistry II. 3 Hours.

A study of the principles of basic enzymology, including chemical reactions, biosynthesis, and metabolism. In addition, the course will cover lipids, hormones, vitamins, and minerals. Prerequisite: Graduate standing or permission of instructor. LEC.

MDCM 710. Chemistry of Drug Action I. 4 Hours.

This course provides an overview of topics central to the understanding and practice of contemporary medicinal chemistry. It illustrates the interplay of anatomy and physiology with the organic-, bio- and analytical chemistry of drugs in the body. Topics covered include physiological mechanisms and disease processes; cell structure and function; basic intermediary metabolism; basic principles underlying drug action including the physicochemical properties of drugs and how these affect the interaction of drugs with living systems; chemical and biological manipulation of the absorption, distribution, metabolism and excretion of drugs and prodrugs; kinetics and inhibition of enzymes and transporters; quantitation and molecular modeling of drug binding to targets. Prerequisite: One year of organic chemistry, one semester of biochemistry, and one college-level course in biology. LEC.

MDCM 775. Chemistry of the Nervous System. 3 Hours.

A detailed study of the molecular aspects of nerve transmission will be covered with special emphasis on the uptake, storage, release, biosynthesis, and metabolism of specific neurotransmitters. Drugs affecting these processes and current research on receptor isolation and receptor mechanisms will be discussed from a chemical viewpoint. (Same as BIOL 775, CHEM 775, NURO 775, PTX 775, and PHCH 775.) Prerequisite: Consent of instructor. LEC.

MDCM 785. Natural Products of Medicinal Significance. 2 Hours.

A discussion of bioassay-directed screening, the isolation, structure determination, biosynthesis, partial synthesis and total chemical synthesis of organic natural products of medicinal significance. Examples of the classes of compounds to be considered include steroid hormones, cardiac glycosides, alkaloids, antibiotics, terpenes, and the like. Prerequisite: Graduate standing or consent of instructor. LEC.

MDCM 790. Chemistry of Drug Action II. 3 Hours.

A discussion of the principles of contemporary drug design with specific examples chosen from the original literature. This course covers the organic substances used as medicinal agents, including consideration of their origins, chemical properties, structure-activity relationships, metabolism and mechanisms of action. Prerequisite: Graduate standing or completion of MDCM 625 and MDCM 626. LEC.

MDCM 798. Master's Literature Seminar in Medicinal Chemistry. 1 Hour.

Literature seminar for graduate students in Spring of their 2nd year. Prerequisite: Graduate students in 2nd year of program. LEC.

MDCM 799. Research Seminar in Medicinal Chemistry. 1 Hour.

Reports by research students and discussions of developments in the field not covered in formal courses. LEC.

MDCM 801. Issues in Scientific Integrity. 1 Hour.

Lectures and discussion on ethical issues in the conduct of a scientific career, with emphasis in the conduct of a scientific career, with emphasis on practical topics of special importance in molecular-level research in the chemical, biological, and pharmaceutical sciences. Topics will include the nature of ethics, the scientists in the laboratory, the scientist as author, grantee, reviewer, employer/employee, teacher, student, and citizen. Discussions will focus on case histories. Graded on a satisfactory/unsatisfactory basis. (Same as MDCM 801, NURO 801, PTX 801, PHCH 801 and PHCH 802.) LEC.

MDCM 816. Careers in the Biomedical Sciences. 1 Hour.

Advanced course examining career options open to PhD scientists in the biomedical sciences, and providing preparation for the different career paths. Extensive student/faculty interaction is emphasized utilizing lectures, class discussion of assigned readings, and oral presentations. This course will be graded satisfactory/unsatisfactory. (Same as BIOL 816, CHEM 816, and PHCH 816.) Prerequisite: Permission of instructor. SEM.

MDCM 860. Principles and Practice of Chemical Biology. 3 Hours.

A survey of topics investigated by chemical biology methods including: transcription and translation, cell signaling, genetic and genomics, biochemical pathways, macromolecular structure, and the biosynthesis of peptides, carbohydrates, natural products, and nucleic acids. Concepts of thermodynamics and kinetics, bioconjugations and bioorthogonal chemistry will also be presented. (Same as BIOL 860, CHEM 860 and PHCH 860.) Prerequisite: Permission of instructor. LEC.

MDCM 895. Research in Medicinal Chemistry. 1-12 Hours.

Hours and credit to be arranged. RSH.

MDCM 899. Master's Thesis. 1-12 Hours.

Hours and credit to be arranged. Independent investigation of a research problem of limited scope. Prerequisite: Consent of instructor. THE.

MDCM 950. Advanced Topics in Medicinal Chemistry: _____. 1-3 Hours.

An in-depth discussion of topics of current interest to medicinal chemists. Prerequisite: Consent of instructor. LEC.

MDCM 980. Proposal Preparation and Seminar. 3 Hours.

Presentation of a literature seminar and writing an original NIH-style research proposal concerning contemporary problems in medicinal chemistry. Prerequisite: Consent of instructor. LEC.

MDCM 999. Doctoral Dissertation. 1-12 Hours.

Hours and credit to be arranged. Original chemical research in the synthesis and development of medicinal agents, elucidation of the chemical mechanisms of drug action, drug metabolism, and drug toxicities. THE.