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 8 full-time faculty members, about 20 graduate students, more than 15 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 most of the medicinal chemistry laboratories are located, also houses the departments of Chemistry (http://www.chem.ku.edu) and 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 and will soon occupy space in the Integrated Science Building in central campus. 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), on KU’s west campus, 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 the Shankel Structural Biology Center. 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 602. 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 603. Medicinal Biochemistry III. 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 604. Phytopharmacology. 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 project 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. 5 Hours.
This course provides an overview of physiological mechanisms and
disease processes as well as the basic principles of contemporary drug
design. Modulation of drug absorption, distribution, metabolism and
excretion; drug-like properties; conformational constraint; structure-
based drug design; library generation; HTS hit optimization, produgs;
bioisosteres; Kcat inhibitors; active site directed reversible and irreversible
inhibitors; quantitative SAR; molecular dissection; rigid analogs;
pharmacophores; etc., will be treated. Prerequisite: 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 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.