

## Chemistry 395/425: Medicinal Chemistry

**Spring Semester, 2011**  
**Tue/Thur 5:30-6:50 p.m.**  
**Flanner Hall 105**

**Dr. Daniel P. Becker**  
**Flanner Hall 215**  
**dbecke3@luc.edu**

**Prerequisite:** Organic Chemistry 221/222 or Chem 223/224. This course is open to both undergraduate students (as CHEM 395) and graduate students (as CHEM 425).

**Required Text:** An Introduction to Medicinal Chemistry, 4<sup>th</sup> Edition, by Graham L. Patrick, Oxford University Press, 2009. **ISBN-10:** 0199234477 **ISBN-13:** 978-0199234479

**Blackboard:** Handouts that are given out in class will be posted on Blackboard

**Office Hours:** Wed 3:30-5:30 or by appointment

**Course Description:** This course will provide an in-depth look at how novel, pharmacologically active molecules are designed to treat human diseases. Topics will include selected chapters in the Silverman text, and additional examples and applications will be drawn from the published literature. Selected case histories throughout the course will serve to illustrate the concepts. The course will include guest lecturers from practicing medicinal chemists.

Selected readings and problems will be assigned, both from the text and from the primary literature as handouts. There will be two exams final. Students enrolled in Chem 425 will be required to present a poster presenting work from a recently-published manuscript, and folks in Chem 395 will attend the poster session and summarize the posters presented by the Chem 425 folks. This course is lecture only; there is no lab associated with this course.

### Topics will include:

- Drug discovery
- Molecular design
- Organic synthesis of drug molecules
- Structure-Activity Relationships (SAR)
- Drug interactions with receptors
- Enzyme inhibition and inactivation
- Pharmacokinetics (PK)
- Case Histories
- Patents
- Ethics

### Evaluation

Exam I	100 points (tentatively Tuesday 2-15-11)
Exam II	100 points (tentatively Tuesday 3-22-11)
Homework	ca. 100 points
Posters	100 points (presentations, Chem 425; summaries, Chem 395)
<u>Cumulative Final</u>	<u>100 points Tuesday 5-3-11 in FH-105</u>
Total	ca. 500 points

**Goals of this course include the demonstration of proficiency in understanding:**

- the modes of action of drugs with receptors and enzymes.
- pharmacokinetics of drug action, including ADME.
- toxicity and therapeutic index, and the risk/benefit aspect of medicines.
- the strategies of molecular design of new drugs for receptors or enzymes.
- the synthesis of drug molecules using the reactions of synthetic organic chemistry.
- the metabolism of drugs, and the role of metabolism in PK and drug safety.
- the patent process of protecting intellectual property.
- some of the ethical aspects of drug development and marketing.
- why you may wish to devote your life to the practice of medicinal chemistry.

**Medicinal Chemistry Textbooks**

- *The Organic Chemistry of Drug Design and Drug Action*, by Richard B. Silverman, 2nd Edition. Elsevier Academic Press, 2004, ISBN 0-12-643732-7.
- *Foye's Principles of Medicinal Chemistry*, 5th Edition, by David A. Williams and Thomas L. Lemke, Lippincott Williams & Wilkins, 2002.
- *Medicinal Chemistry: A Molecular and Biochemical Approach*, 3<sup>rd</sup> Edition, by Thomas Nogrady and Donald F. Weaver, 2005.
- *Medicinal Chemistry, An Introduction*, by Gareth Thomas, John Wiley & Sons, 2000.
- *The Practice of Medicinal Chemistry*, ed. Camille Wemuth, Academic Press, 1996.

**Selected Medicinal Chemistry Journals**

- *Journal of Medicinal Chemistry*
- *Journal of Medicinal Chemistry Letters* (starting with 2010, Volume 1)
- *Bioorganic & Medicinal Chemistry*
- *Bioorganic & Medicinal Chemistry Letters*
- *European Journal of Medicinal Chemistry*
- *ChemMedChem*

**Additional Resources**

- *Annual Reports in Medicinal Chemistry*
- The U.S. Patent and Trademark Office at <http://www.uspto.gov/>
- Free patent pdf files are available at: <http://www.freepatentsonline.com/>

**Academic Honesty:** For this course, all exams are closed book and closed note unless otherwise prescribed. Academic dishonesty includes using notes or books during exams, looking at another student's test during the exam period, talking during an exam, and plagiarizing in written assignments. Punishment for academic dishonesty is failure of the course, and the incident will be reported to the Chemistry Department Chair and the Office of the Dean. Additional sanctions, including expulsion from the university, may be imposed. The Undergraduate Handbook (pp 12-13) contains a complete description of the University policy regarding academic dishonesty.

Chemistry 395/425 Med Chem *Tentative* Outline – updated 1-18-11

Week	Date	Topic
1	Jan 18	Drug discovery, routes of administration
	Jan 20	Drug leads and pharmacokinetics (PK), ADME
2	Jan 25	Structure-Activity Relationships (SAR)
	Jan 27	Structural modifications in drug design
3	Feb 1	Oral bioavailability
	Feb 3	Quantitative SAR
4	Feb 8	Receptor interactions
	Feb 10	Receptor interaction theories
5	Feb 15	<b>Exam 1</b>
	Feb 17	Stereochemistry
6	Feb 22	Enzymes
	Feb 24	Enzyme mechanisms
7	Mar 1	Enzyme inhibition
	Mar 3	Reversible enzyme inhibitors
8	Mar 8	<b>Spring Break</b>
	Mar 10	<b>Spring Break</b>
9	Mar 15	Transition-State inhibitors
	Mar 17	Irreversible enzyme inhibitors/inactivators
10	Mar 22	<b>Exam 2</b>
	Mar 24	Case Studies - antibiotics
11	Mar 29	Enzyme inhibitors - case studies
	Mar 31	Dr. Kathy Mortell, Versicor/Abbott: discovery of antibiotics
12	Apr 5	Drug Metabolism
	Apr 7	Dr. Tom Penning, Pharmacia/Abbott: Celebrex Discovery; Anticancer
13	Apr 12	Types of drug metabolism
	Apr 14	Clara Villamil, Pharmacia/Abbott: anticancer MMP inhibitors
14	Apr 19	Prodrugs
	Apr 21	<b>Easter Break</b>
15	Apr 26	Dr. Stanley Lapidus, Rush-Presbyterian: Public Policy/Health Care
	Apr 28	Poster Session
16	May 3	<b>Final Exam (cumulative)</b>