CHEM167: Introduction to Medicinal Chemistry

General Course Information
Course Number CHEM167, 4 units

Course Faculty

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Class sessions
Lectures:
12:30-1:50PM Tu/Th in 120 PCYNH
Discussion
TBA

Course Philosophy
The course will be structured around ability-based education. Students will integrate knowledge, attitudes, and skills and in a variety of ways to accomplish the course outcomes.

The procedures in ability-based education are:

- Clearly define and make public the *ability outcome and objectives* students are expected to achieve during the course
- Give students multiple opportunities to achieve the course objectives
- Provide clear criteria so students can know how well they are performing the abilities during their practices
- Provide feedback from the faculty, peers, and self to determine how successfully students are meeting the criteria

The overall goal of this course is to enable students to integrate their knowledge from a number of disciplines to form a conceptual understanding of how medicinal chemistry, including drug action and strategies for drug design. Emphasis will be placed on understanding: (i) molecular interactions in vivo and in vitro environments, (ii) strategies for drug development, (iii) and the current state-of-the-art as it relates to research-related applications.

Course Description
This upper-level undergraduate course will walk students through the basics of medicinal chemistry, broadly defined. Students will utilize the knowledge gained in organic chemistry, biochemistry, molecular biology, physical chemistry, pharmacology and physiology in an integrated fashion as applied to modern medicinal chemistry. Topics will include rigorous descriptions of receptor-protein structure, dynamics, and interactions; different strategies of drug development and design; pharmacodynamics and pharmacokinetics. Extensive discussion of current limitations of the field and real-life case studies will be included.

Course Ability Outcomes and Objectives
At the conclusion of the course, students shall be able to:

1. Understand the basic principles and concepts of receptor and ligand structure, dynamics, and interactions
2. Understand pharmacokinetic and ADME principles from the molecular to clinical level, and how these principles impact design of modern pharmaceuticals
3. Be familiar with the major classes of drugs, their pharmacodynamic properties and mechanisms of action
4. Be "fluent" in at least one macromolecular structure viewer software package, as well as understand and know how to perform in silico docking calculations
5. Understand various drug discovery and design strategies and be able to apply them appropriately in an actual research program, using critical thinking and "best practice" problem solving skills

Course Prerequisites
Background should include Chemistry 1A and 2A, Organic Chemistry 51A and 51B, Chemistry 51C, Biological Sciences 97 (Genetics), Biological Sciences 98 (Biochemistry), and/or Chemistry 128. Biological Sciences 99 (Molecular Biology) would be helpful but is not required.

Grading

Assessment Tool	Percentage of Grade
Learning Assurance: Midterm Pre-final	10%
Team Exams: Midterm Pre-Final	10%
Mid-term	40%
Final	40%

Exams
There will be 2 exams in this course, a midterm and a final. It is important to be on time to all exams. Exams will start on time; any student that is late will not be allotted extra time to finish their exam. Make up exams will be allowed ONLY IN THE CASE OF EXTREME EMERGENCIES AND ILLNESS and only with appropriate documentation.

Team Exams
Students will be divided into small groups of ~5 students. At the end of the midterm and final, students will take a team exam. The team exams will encourage group discussion and teamwork.

Learning Assurance
These sessions take place during the discussion session for the midterm and pre-final and are intended for discussion of missed core competency exam questions and for clarification of major concepts discussed in lecture. Credit will be given for attendance. Sign-in sheet and random roll call will verify attendance during sessions.

Extra Credit
There will be extra credit for the course, which involves answering a question(s) about the book "The Billion-Dollar Molecule," by Barry Werth.

Academic Dishonesty
Academic dishonesty, or even the appearance of academic dishonesty, in any way, shape, or form, is subject to a zero tolerance policy. Immediate and final action will be taken upon first offense.

Request for Examination Re-grade
Any request by a student to have an examination regarded must be made in writing and submitted to the course faculty or teacher assistant within two working days of return of the exam. The written justification should be in the following format:

1. Written justification should be on a separate paper. Students should not write their comments on the exam.
2. Specify which question(s) and answer(s) are to be reconsidered in the request
3. Justification for your answer. In a concise manner, explain why you selected your answer rather than the correct answer. When possible, please reference specific citations from the course textbook or lecture material.

The faculty member will review the material and respond to the student within two working days of receiving the written request. All such decisions are final.

Textbooks and Other Suggested Reading Materials
Required textbook:
"An Introduction to Medicinal Chemistry" by Graham Patrick, Fourth Edition

Recommended textbooks and reading:
Scientific journals: Nature, Science
Brody's Human Pharmacology, Fifth Edition
Foye's Principles of Medicinal Chemistry, Sixth Edition, by Lemke & Williams
Molecular Biology of the Cell, Fifth Edition, by Alberts et al.
Biochemistry, Second or Third Edition, by Stryer
Medicinal Chemistry, Second Edition, by Gareth Thomas
Drug-like Properties: Concepts, Structure Design and Methods, by Kerns & Di (Academic Press)
The Billion-Dollar Molecule, by Barry Werth (Simon & Schuster)

Course Schedule**

Week	Topic
1 Apr 2, 4	Introduction to Med Chem Chapters: 1, 6, 2
2 Apr 9, 11	Organism, tissues, cells, molecules and interactions Chapters 3, 7
3 Apr 16, 18	Receptors, pharmacokinetics, ADME Chapters 4, 8, 11
4 Apr 23, 25	Drug Action – Pharmacokinetics, ADME, toxicology
5 Apr 30, May 2	Drug Discovery, SAR, Enzyme Catalysis (Chap 12) Midterm
6 May 7, 9	Computers in Med Chem; Combichem (Chapters 16, 17)
7 May 14, 16	Cancer & anti-cancer agents: p53, angiogenesis Chapter 21
8 May 21, 23	Cancer & anti-cancer agents: kinases, signaling proteins Antibiotics (Chapter 19)
9 May 28, 30	Viruses & antivirals: HIV, proteases; Influenza, sialidases Chapter 20
10 Jun 4, 6	Cardiovascular diseases (Chapter 23) Comprehensive review, pre-final learning assurance
11 TBD	Final Exam, week of Jun 10

**** The right to change this in real-time if needed is reserved by the instructor.**