

SYLLABUS¹

CHEM 2330.PAC – INTRODUCTORY ORGANIC CHEMISTRY FOR MEDICAL SCIENCE

FALL 2013

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Hours: TBA

COURSE PREREQUISITES: General Chemistry I and II or equivalent.

COURSE DESCRIPTION: This course covers fundamental concepts and selected material from the traditional two-semester Introductory Organic Chemistry lecture sequence (CHEM 2323 and CHEM 2325). This course is required for students in the Partnership in Advancing Clinical Transition (UT-PACT) Program. This course does not satisfy the basic organic chemistry lecture requirements for pre-health profession students.

LEARNING OBJECTIVES

- Understand the rules of chemical bonding molecular structure, potential energy-stability relationships, Lewis structures, resonance theory, conformational analysis, and stereochemistry.
- Identify centers of reactivity in organic structures, including the names, structures, and basic chemical properties of the most important functional groups.
- Understand the principles of common reaction mechanisms and their energetics.
- Understand the basic concepts of the Lewis and Bronsted-Lowry theories of acids and bases.
- Understand the structural features and chemistry of the most important functional groups, with additional examples from biological systems when relevant.
- Understand the basic concepts of organic transformations and laboratory synthesis, including biosynthetic pathways when appropriate.

REQUIRED TEXTBOOK: John McMurry. [*Organic Chemistry with Biological Applications. 2nd. ed.*](#) Note: Only the regular textbook is required. The Study Guide and Solutions Manual is not required, but strongly recommended (see below).

RECOMMENDED MATERIALS

1. Solutions Manual

Susan McMurry. [*Study Guide and Solutions Manual*](#) (ISBN: 0-495-39145-X). This ancillary contains the answers to the problems in the textbook, so it is strongly recommended. You might find it cost-effective to either buy the [textbook/solutions manual bundle](#), or share the cost of one copy with other students, since you won't need it on a regular basis.

2. Student recommended reference textbooks (Current prices range about \$30 - \$40, depending on the vendor).

- [*Organic Chemistry I as a Second Language*](#) by David R. Klein. Covers basic principles such as resonance structures, curved arrows, orbital hybridizations, etc.
- [*Organic Chemistry II as a Second Language*](#) by David R. Klein. Coverage of typical concepts presented in second semester courses. Publisher's site: same as above.
- [*Get Ready for Organic Chemistry*](#) by Joel Karty.

¹ The descriptions and timelines presented in this syllabus are subject to change at the discretion of the Professor.

3. **Molecular model sets.** If you wish to enhance your ability to visualize 3-dimensional features and movements in organic structures, you may benefit from using a molecular model set. Some reasonably priced kits, yet adequate for student use, can be obtained from the following vendors. Expect to spend at least \$20 for a good kit. If you go too cheap you will end up with junk.

- [Molecular Visions](#).
- [Indigo](#). Has *Molymod* sets for organic chemistry.
- [Amazon.com](#). Search for "molecular model sets."

CLASS SCHEDULE – SPRING 2013

Note: The test and assessment dates will be announced the first week of class.

TOPICS COVERED	CHAPTER
Atomic structure and bonding	1
Polar covalent bonds	2
Alkanes & conformational analysis	3, 4
Stereochemistry at tetrahedral centers	5
TEST # 1 on chapters 1 – 5 and associated class notes	
Overview of organic reactions	6
Bronsted acid-base chemistry	2
Organohalides: Nucleophilic substitutions & eliminations	12
Alkenes and alkynes	7
Reactions of alkenes & alkynes	8
TEST # 2 on chapters 6 – 8, 12, and associated class notes	
Aromatic compounds	9
Structure determination: MS, IR, & UV spectroscopy	10
Structure determination: NMR spectroscopy	11
Alcohols, ethers, and related sulfur compounds	13
TEST # 3 on chapters 9 – 11, 13, and associated class notes	
Aldehydes & ketones: Nucleophilic additions	14
Carboxylic acids & nitriles	15
<i>FALL BREAK</i>	
Carboxylic acid derivatives: Nucleophilic acyl substitutions	16
Carbonyl alpha-substitutions & condensations	17
Amines & heterocyclic compounds	18
FINAL EXAM – Comprehensive	

TOPIC DESCRIPTIONS

Chapter 1: Atomic structure and bonding. Review of atomic structure and bonding theory, hybridization theory, and types of molecular formulas.

Chapter 2: Polar covalent bonds. Polar covalent bonds, formal charge, and resonance structures.

Chapters 3 & 4: Alkanes and conformational analysis. Rules of organic nomenclature, structure, and conformations of alkanes & cycloalkanes.

Chapter 5: Stereochemistry. Symmetry and chirality of carbon and heteroatoms, stereoisomerism, rules for specifying configuration, chiral environments and the differentiation of stereoisomers, meso forms.

Chapter 6: Overview of organic reactions. Introduction to molecular transformations and reaction mechanisms, equilibrium and thermodynamics, reaction rates, comparison between laboratory reactions and reactions in biological systems.

Polar mechanisms and Bronsted acid-base chemistry. Structure-acidity relationships and trends.

Chapter 12: Polar mechanisms and Nucleophilic substitutions. Alkyl halides as synthetic precursors, introduction to Lewis acid-base theory, nucleophilic substitutions & eliminations of tetrahedral carbon.

Chapters 7 and 8: Alkenes and alkynes. π -bonds in organic compounds, preparations and reactions of alkenes and alkynes, reactions of conjugated systems, biological additions of radical to alkenes.

Chapters 9: Aromatic compounds. Aromaticity of carbon and heterocyclic compounds, electrophilic and nucleophilic aromatic substitutions, oxidations and reductions, introduction to organic synthesis.

Chapters 10: Structure determination: MS, IR, & UV spectroscopy. Introduction to organic spectroscopy and structure determination techniques, mass spectrometry, infrared and ultraviolet spectroscopy.

Chapters 11: Structure determination: NMR spectroscopy. Proton and carbon nuclear magnetic resonance spectroscopy, special techniques and their uses. Magnetic resonance imaging in medicine.

Chapter 13: Alcohols, ethers, and related sulfur compounds. Structure, chemistry, and biological reactions of alcohols, phenols, thiols, ethers, and sulfides. Protection of alcohols in organic synthesis.

Chapters 14: Aldehydes & ketones. Chemistry of carbonyl compounds, nucleophilic additions, Wittig and Grignard reactions, biological reductions, conjugate additions to α,β -unsaturated carbonyl compounds.

Chapters 15: Carboxylic acids & nitriles. Structure and chemistry of carboxylic acids and nitriles, biological acids and the Henderson-Hasselbalch equation, structure-acidity relationships.

Chapters 16: Carboxylic acid derivatives. Structure and nomenclature of carboxylic acid derivatives, nucleophilic acyl substitution reactions, biological carboxylic acid derivatives, organic polymers.

Chapters 17: Carbonyl α -substitutions and condensations. Enols and enolate chemistry, tautomerism, α -substitutions of carbonyl compounds, aldol condensations and related reactions, Michael and Stork reactions, biological carbonyl condensation reactions.

Chapters 18: Amines & heterocyclic compounds. Structure & chemistry of amines, biological amines and the Henderson-Hasselbalch equation, heterocyclic amines, fused-ring heterocycles,

GRADING

The final grade is based on assignments, short assessments typically covering two chapters each, two of three partial tests, and a comprehensive final exam, as listed below. Additional detail regarding each item will be provided in class:

- **Assignments** **15%**
- **6 of 7 assessments** **20%**
- **2 of 3 partial tests** **30%**
- **Comprehensive final exam** **35%**

LETTER GRADE EQUIVALENTS OF FINAL PERCENTAGE GRADE

95 - 100 = A+	80 - 84 = B+	65 - 69 = C+	50 - 54 = D+
90 - 94 = A	75 - 79 = B	60 - 64 = C	45 - 49 = D
85 - 89 = A-	70 - 74 = B-	55 - 59 = C-	40 - 44 = D-