

BioOrganic Chemistry

CHMC47S

Course Outline

LEC01: Fri 9:00-11:00, S-143.

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Required Text Books:

J. McMurry, Organic Chemistry, 6th ed., Brooks/Cole.

J. McMurry, *Study Guide and Solutions to Organic Chemistry*, 6th ed., Brooks/Cole;

Additional Reference:

P. Y. Bruice, Organic Chemistry, 4th ed, Pearson.

Note: All assigned problems for lectures 1-10 are from J. McMurry, Organic Chemistry. All assigned problems for lectures 11 and 12 are from P. Y. Bruice, Organic Chemistry, 4th ed, Pearson.

Method of Evaluation:

Test # 1: 15% (October 7th)

Midterm Test: 35% (Tentative date October 28th)

Final Exam: 50% (Dec exam period 10th-21st)

Lecture 1. Sept 16th 2005

Biomolecules: Carbohydrates (Chapter 25)

- Classification of Carbohydrates
- Carbohydrate Stereochemistry
- D,L Sugars
- Configurations of Aldoses
- Epimerization, Isomerization
- Cyclic Structures of Monosaccharides
- Monosaccharide Anomers
- Mutorotation
- Reactions of Monosaccharides: Ester Formation
- Reactions of Monosaccharide: Ether Formation
- Reactions of Monosaccharides: Glycoside Formation

Lecture 2. Sept 23rd 2005

Biomolecules: Carbohydrates

- Monosaccharides: Glycoside Formation
- Mechanism of Glycoside Formation
- The Anomeric Effect
- Determination of Ring Size from the Open Chain Form.
- Determination of Ring Size by Oxidizing the Acetal with Excess HIO_4
- Reduction of Monosaccharides
- Oxidation of Monosaccharides
- Osazone Formation
- The carbon chain of an aldose can be increased by one carbon in a Kiliani–Fischer synthesis
- Chain Shortening: The Wohl Degradation- Shortens Aldose Chain by One Carbon
- Stereochemistry of Glucose: The Proof
- Disaccharides
- Polysaccharide
- Other Important Carbohydrates
- Blood Type

Assigned problems: 2-27, 32-44, 46, 47, 48, 54, 56, 58, 60, 61-63, 65-67

Lecture 3. Sept 30th 2005

Biomolecules: Amino Acids, Peptides, and Proteins (Chapter 26)

- Amino Acids and Peptides
- Configuration of aminoacids
- Isoelectric Point, pI
- Electrophoresis
- Reaction of Amino Acid with Ninhydrin
- Synthesis of Amino Acid
- Resolution of R,S Amino Acid: Method I
- Resolution of R,S Amino Acid: Method II

Lecture 4. Oct 7th 2005 Test # 1 (60 min)

Biomolecules: Amino Acids, Peptides, and Proteins

- Enantioselective Synthesis of Amino Acids
- Peptides
- Peptide Bond
- Disulfide Bond

Lecture 5 October 14th 2005

Biomolecules: Amino Acids, Peptides, and Proteins

- Structure Determination of Peptide: Amino Acid Analysis

- Peptide Sequencing: Edman Degradation
- Peptide Sequencing: C-Terminal Residue Determination
- Peptide Synthesis
- Strategy for Making a Specific Peptide Bond
- Automated Peptide Synthesis
- Cyanogen Bromide Hydrolyses the Amide bond on the C-side of a Methionine Residue
- Protein Structure

Assigned problems: 1-21, 27-53, 56-62

Lecture 6. October 21st 2005

Biomolecules: Lipids (Chapter 27)

- Waxes, Fats and Oils
- Soap
- Phospholipids
- Sphingomyelin
- Prostaglandins
- Terpene
- The Isoprene Rule
- Myrcene

Lecture 7. October 28th 2005

Biomolecules: Lipids

- Terpenes
- The Conversion of Mevalonic Acid into Mevalonyl Phosphate
- Biosynthesis of Terpenoid
- Formation of Farnesyl Pyrophosphate
- Formation of Squalene, the Precursor of Cholesterol
- Steroids
- Stereochemistry of Steroids
- Steroid Biosynthesis

Assigned problems: 1-12, 18-28, 31-39, 41, 43-46

Lecture 8. Nov 4th 2005

Heterocycles and Nucleic Acids (Chapter 28)

- Five-Membered Unsaturated Heterocycles
- Structures of Pyrrole, Furan and Thiophene

- Electrophilic Substitution Reactions of Pyrrole, Furan, and Thiophene
- Pyridine
- Nucleophilic Substitution of Pyridine
- More Examples of Heterocyclic Compounds
- Nucleic acids and Nucleotides
- Structure of Nucleic acids
- Base Pairing in DNA: The Watson-Crick Model

Lecture 9. Nov 11th 2005
Heterocycles and Nucleic Acids

- Semiconservative Replication
- Structure and Synthesis of RNA: Transcription
- RNA and Protein Biosynthesis: Translation
- DNA Sequencing
- DNA Synthesis

Assigned problems: 1, 3-19, 24-51

Lecture 10. Nov 18th 2005
The Organic Mechanisms of the Coenzymes

- The vitamins
- Niacin: The Vitamin Needed for Many Redox Reactions
- The Components of NAD⁺
- Mechanism for Pyridine Nucleotide Coenzymes
- The Mechanism of Reduction by NADH (or NADPH)
- The Mechanism of Reduction by NADH (or NADPH)
- Flavin Adenine Dinucleotide (FAD)
- Thiamine Pyrophosphate: Vitamin B1
- Biotin: Vitamin H

Lecture 11. Nov 25th 2005
The Organic Mechanisms of the Coenzymes (P. Y. Bruice, Organic Chemistry, 4th ed, Pearson, Chapter 25)

- Pyridoxal Phosphate (PLP): Vitamin B6
- PLP Catalyzed Decarboxylation
- PLP Catalyzed Transamination
- Mechanism for Racemization
- Tetrahydrofolate (THF): Folic Acid
- The Six Different THF-Coenzymes
- Enzyme that convert U's in to T's
- Conversion of Dihydrofolate Back to N⁵, N¹⁰-Methylene-THF

- Mechanism Based Inhibitor or Suicide inhibitor
- Competitive inhibitor

Assigned problems: 2-17, 20, 22 d, e, g-j, 30-36

Lecture 12. Dec 2nd 2005
Organic Chemistry of Drugs

- Some Examples of Drugs
- Molecular Modification to Improve the Therapeutic Properties of Cocaine
- Anesthetics Obtained through Molecular Modification
- Drugs as Enzyme Inhibitors
- Drugs that Inhibit Penicillinase
- Mechanism of Penicillinase Inhibition by Sulfone
- Designing a Suicide Substrate
- A Suicide Substrate Inhibits the Transamination
- Approach in Rational Drug Design