

CHEM 4485W: Advanced Topics in Chemistry
Topic: Bioorganic Chemistry

Fall 2007

TR 12:30 – 1:45 PM

TLC 2105

Instructor: Dr. Partha Ray (TLC 2123; phone: 678-839-6023; email: psray@westga.edu)

Course Summary: You will be introduced to the chemistry of biologically important organic compounds and we will discuss the discovery, synthesis, and mechanism of action of a variety of selected pharmaceutical agents. You will use, and build on, the concepts and principles learned in general organic chemistry and see how they are applied to the drug discovery process.

WAC Course: This course has been designated as a Writing Across the Curriculum course. The writing component of this course is designed to help you to understand and communicate the science involved in this class. You will be required to answer several essay type questions as part of three take home tests to fulfill the WAC requirements. The Writing Center can assist you with your writing assignments or projects. It is located in the Perkman Room, TLC 1201. Their phone number is 96513, and their web address is www.westga.edu/~writing.

Topics to be Covered:

1. Chemistry of Carbohydrates

Classifications

Configurations of Monosaccharides

D, L Sugars

Cyclic Structures of Monosaccharides: Hemiacetal Formation

Monosaccharide Anomers: Mutarotation

Reactions of monosaccharides

Di- and Polysaccharides and Their Synthesis

Other Important Carbohydrates

2. Chemistry of Amino Acids, Peptides, and Proteins

Structures of Amino Acids

Isoelectric Points

Synthesis of α -Amino Acids

Peptides and Proteins

Covalent Bonding in Peptides

Structure Determination of Peptides: Amino Acid Analysis

Sequencing of Peptides: The Edman Degradation

Sequencing of Peptides: C-Terminal Residue Determination

Synthesis of Peptides

Automated Peptide Synthesis: The Merrifield Solid-Phase Technique

Classification of Proteins

Protein Structure

Enzymes

How Do Enzymes Work? Citrate Synthase

Protein Denaturation

- 3. Chemistry of Lipids**
 - Waxes, Fats, and Oils
 - Soap
 - Phospholipids
 - Prostaglandins
 - Terpenes
 - Biosynthesis of Terpenes
 - Steroids
 - Stereochemistry of Steroids
 - Steroid Biosynthesis
 - Synthesis of Terpenes and Steroids
- 4. Heterocyclic Compounds**
 - Five-Membered Unsaturated Heterocycles: Reactions and Synthesis
 - Six-Membered Unsaturated Heterocycles: Reactions and Synthesis
 - Fused-Ring Heterocycles
- 5. Nucleosides, Nucleotides, and Nucleic Acids**
 - Structures
 - Base Pairing in DNA: The Watson-Crick Model
 - Replication of DNA
 - Structure and Synthesis of RNA: Transcription
 - RNA and Protein Biosynthesis: Translation
 - DNA Sequencing
 - DNA Synthesis
 - The Polymerase Chain Reaction
- 6. The Organic Chemistry of Folates and Cancer Chemotherapy**
 - Biosynthesis of tetrahydrofolate
 - Conversion of Uridine monophosphate to Thymidine monophosphate
 - MOA of 5-Fluorouracil
 - Folate-based Inhibitors of DHFR, TS, and GARFT
 - Discovery and Synthesis of Lometrexol, and ALIMTA
 - Progress towards the synthesis pyrimidodiazepine-based folates as potential anti-cancer agents

Textbook: "Organic Chemistry" 5th or 6th edition by John McMurry.

Grade: Your grade will be based on the average from three take home tests.

A: 85-100; B: 75-84; C: 60-74; D: 50-59; F: 0-49

Test dates: Take Home due dates: September 25, November 6, December 4

Office hours: MWF: 10:00 – 11:00 AM & 1:00 – 3:00 PM; T: 2:00 – 3:00 PM

Note: Extra credit is not allowed for this class, and work completed for another class will not be accepted in this class. All communications outside of class should be via campus mail (myUWG), and you are expected to check your mail regularly.

Learning Outcomes

1. Reason and think analytically in solving problems and making decisions in matters involving bioorganic chemistry. Attainment of this learning outcome will be reflected by the students ability to:

Understand the reactions and synthesis of natural products as well as the mechanism of action and synthesis of selected medicinal agents.

2. Apply a basic understanding of the systematic methods of scientific inquiry, principles and procedures to investigate problems. Attainment of this learning outcome will be reflected by the students ability to:

Use chemical logic to describe the mechanisms of new organic reactions not covered in general organic chemistry.

3. To communicate matters of organic synthesis with clarity. Attainment of this learning outcome will be reflected by the students ability to:

Successfully complete written and oral assignments, and examinations.