

# Synthetic Strategies

Chem 6119

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## Overview

An essential and invaluable skill of most experimental chemists, and a commercial target of many commercial enterprises, is the generation of new and useful chemical compositions of matter. This skill may involve the assembly of commercially available structural fragments to generate new small (mw < 500) molecules as drugs, monomers, commodities, and/or chemical probes, or the synthetic manipulation of larger molecules, such as high molecular weight synthetic polymers, proteins, and/or natural products, in order to optimize their specific properties.

This class focuses on the commonly employed contemporary techniques to effect structural transformations. Instruction involves in-class discussions of current (2008-2010) synthetic articles, with focus on the specific methodology and strategies employed. As the class progresses, students are queried as to how they would effect specific structural transformations, involving one or many synthetic steps. The class format is that of open discussion of the presented transformations.

This class assumes a working knowledge of fundamental chemical principles as covered in Advanced Organic Chemistry (Chem 5398). While lecture material utilizes only current synthetic literature, ancillary discussions will involve the chemical stability/susceptibility of various functionalities, the use of protecting groups, methodology to form new carbon-carbon bonds (including metal-catalyzed processes), techniques to generate and maintain stereochemistry, and methodology for selectively transforming one functional group into another within a multifunctional molecule.

## **Textbooks and Reading**

While required reading utilizes the primary literature (journal articles), the following optional textbooks provide insightful discussions of specific reactions. Professional synthetic chemists will own one or more of these texts.

*Strategic Applications of Named Reactions in Organic Synthesis* by Lazlo Kurti and Barbara Czako, 2005, Academic Press, ISBN 978-0124297852.

*Advanced Organic Chemistry, Part B, Reactions and Synthesis*, Fifth Edition, 2007, Springer, ISBN 978-0387683508.

*Organic Synthesis* by Michael B. Smith, 2001, McGraw-Hill, ISBN 978-0070482425.

**Teaching Objectives:**

- 1) Provide a reasonably comprehensive coverage of commonly employed synthetic techniques, including the use of protecting groups, methodology to form carbon-carbon bonds, functional group manipulations, and the incorporation of stereochemical centers.
- 2) Illustrate effective and economically feasible methodology for synthesizing new molecules.
- 3) Provide the student with a working knowledge of the chemical stabilities and sensitivities of common functional groups.

**Student Outcomes**

Upon completing this course, it is anticipated that the student will:

- 1) Possess ability to design and implement the synthesis of multifunctional molecules.
- 2) Possess knowledge of the chemical properties of commonly encountered functional groups, including their need for protection under specific reaction conditions.
- 3) Possess a reasonably comprehensive knowledge of commonly employed synthetic reagents.

**Grading:** Each week, a homework set will be assigned and grading will be a combination of scores on the written homework assignments and on daily classroom participation.

**Expectations of the Student:** I anticipate that, for every hour of class time, approximately two to three hours will be spent reading and completing written homework.