

Course Syllabus: Strategies and Tactics in Organic Synthesis

CHEM 240T, Fall 2019

Instructor: Hubert Muchalski, Ph.D.

General information

- **Course name and number:** Strategies and Tactics in Organic Synthesis; CHEM 240T (graduate, 2 Units)
- **Contact:** Science 1 room 352, phone (559) 278-2711, hmuchalski@mail.fresnostate.edu
- **Canvas:** The central repository for all course materials and information is our Canvas site, accessible through <https://fresnostate.instructure.com/courses/4365>. The Canvas site will house your grades, links to handouts, videos, and other materials.
- **Textbook:** There is no specific textbook for this class but I recommend you get a copy of organic chemistry textbook to use as general reference. It doesn't have to be recent. Older edition of any major textbook will work just as well.
- **Tech:** Scifinder scholar account to access and search the database. EndNote, and ChemDraw, both available for free for Fresno State students. Refer to instructions on how to obtain the software (Canvas).
- **Office Hours:** I will be available for consultations after each class meeting. Walk-in office hours are Monday and Wednesday 12:00–01:00 pm. Additional consultation appointments can be scheduled through calendar function "Find Appointments" on Canvas.

Introduction

When you took the sophomore course in organic chemistry, you studied the typical reactions of haloalkanes, alkenes/alkynes, aromatic compounds and organic carbonyl compounds, etc. That was to introduce you to compound classes and to give you an understanding of how and why such reactions occur. However, the course did not focus how to design a synthetic route to prepare a given organic compound from readily available starting materials. This is a crucial aspect of organic chemistry. The design and synthesis of novel organic compounds is fundamental to the development of new medicines, agrochemicals, plastics, dyestuffs, etc. This course will introduce you to the ideas involved in synthetic design, particularly 'retrosynthetic analysis' (RSA).

Student Learning Outcomes

Students who successfully complete this course should be able to:

- be familiar with the terminology of retrosynthetic analysis (RSA);

- distinguish factors such as chemoselectivity, regioselectivity, stereoselectivity and protecting group methodology and their importance in synthetic design;
- identify synthons and their synthetic equivalents and functional group interconversions;
- use RSA to design and evaluate syntheses of target molecules of medium complexity
- evaluate a synthetic plan and identify flaws in synthetic design
- propose a plausible reaction mechanism for a given reactions

Topics

- Retrosynthetic Analysis (RSA)
- Disconnection via Functional Group Interconversion
- Protecting Groups
- Carbon–Carbon Bond Disconnections
- Synthesis of Compounds Containing Rings
- Stereochemistry: Prediction and Control
- Cross-Coupling Reactions
- Two-Directional Synthesis
- Catalysis

What to expect

The learning mode that will dominate our class meetings is deep analysis of published syntheses of case studies. The goal of this course is not to cover all strategies and tactics used in organic synthesis but to provide opportunities for development of a skill which you need to master as a graduate student: to quickly learn complex and unfamiliar science topics to the degree that you can teach them to others.

Active participation in class discussions is key to getting the most out of this class. Expect to be called to the board on a weekly basis to discuss synthetic and mechanistic problems. Don't be concerned if you feel weak in some areas. By working through a problem you will strengthen your understanding and refine thinking process. This means that it is of utter importance that you come to class prepared.

Reading, researching, and working through problems should be your primary out-of-class activities.

Types of graded work

There are three types of graded work you will encounter in this course:

1. Problem sets
2. Midterm take-home exam
3. Synthesis proposal
4. Proposal presentation

Problem sets are written homework assignments containing synthetic problems and mechanisms. We will review some of those problems and students will be asked to go to the board and solve the

problem in front of the group. Thus, just having the answer may not be sufficient to receive full credit on the assignment if you are not able to develop the solution again.

The take-home exam will be just like problem sets but bigger (more problems) and more comprehensive.

Each student will also propose total synthesis of natural product and present it to the class.

Final letter grade scheme

Grade brackets are imposed by course coordinator. In the past, the grading scale followed a pattern close to the following: A = 90–100, B 80–89, C 70–79; D 60–69; and F <60.

| Grade component | Subtotal |
|------------------------|----------|
| Problem Sets | 50% |
| Midterm take-home exam | 20% |
| Synthesis Proposal | 15% |
| Presentation | 15% |

Course policies

Technology issues when submitting work

For assignments submitted electronically, it is your responsibility to make sure they are submitted on time, through any means necessary, even if technology issues arise. If a tech issue arises, it is your responsibility to find another way to get it to me (for example, via an email attachment). Technology issues that are avoidable or resolved with a simple work-around will not be considered valid grounds for a deadline extension.

Academic Dishonesty

For most assignments you are allowed and encouraged to work with others. However, the final product that you submit for feedback must be the result of your own efforts. Therefore you may share ideas and strategies with others, but collaboration on the actual finished product you submit is not allowed. Your work is expected to be the product of your own thinking, written and explained in your own words with no parts of the work copied from external sources such as books or websites, and done clearly enough in your own mind that you could explain the work from start to finish if asked. Specifically, this excludes:

- copying work from another student;
- copying work from a website;
- paraphrasing work done by another student or from print or internet resources—i.e. putting it in your own words—without coming up with the main ideas and strategies yourself; and
- *allowing or enabling* another student to copy or paraphrase work that you did, even if you did the original work yourself.

Violation of this policy is considered “academic dishonesty” and carries with it strong punitive measures mandated by Fresno State, including possible automatic failure of the course or suspension from the university. For details, please see APM 235 by going to <http://www.fresnostate.edu/aps/documents/apm/235.pdf>.

You may feel tempted to academic dishonesty at some point in the semester. The work can be difficult, and many of you are under a lot of stress. If you are considering academic dishonesty, please STOP, take a breath, and remember that your classmates and I want you to succeed in the course. You are not alone, and you have a strong network in the class for getting help.

Dropping the course after the census date

A *serious and compelling reason* is defined as an unexpected condition that is not present prior to enrollment in the course that unexpectedly arises and interferes with a student's ability to attend class meetings and/or complete course requirements. The reason must be acceptable to and verified by the instructor of record and the department chair. The condition must be stated in writing on the appropriate form. The student must provide documentation that substantiates the condition.

Failing or performing poorly in a class is not an acceptable “serious and compelling reason” within the University policy, nor is dissatisfaction with the subject matter, class or instructor.

University policies and disclaimers

In addition to course policies, you are expected to be familiar with Academic Regulations described in the [University Catalog](#) as well as policies listed below.

Students with Disabilities: Upon identifying themselves to the instructor and the university, students with disabilities will receive reasonable accommodation for learning and evaluation. For more information, contact Services to Students with Disabilities in the Henry Madden Library, Room 1202 (278-2811).

- Class Schedule Policies: <http://fresnostate.edu/studentaffairs/classschedule/policy/>
- Copyright Policy: <http://libguides.csufresno.edu/copyright>
- Students with Disabilities: <http://fresnostate.edu/studentaffairs/careers/students/interests/disabilities.html>
- Academic Integrity and Honor Code: <http://www.fresnostate.edu/academics/facultyaffairs/documents/apm/236.pdf>
- Policy on Cheating and Plagiarism: <http://fresnostate.edu/studentaffairs/studentconduct/policies/cheating-plagiarism.html>
- Add/Drop Course: <http://www.fresnostate.edu/studentaffairs/registrar/registrar/>
- Computer requirements: <https://www.fresnostate.edu/catalog/academic-regulations/index.html#computerreq>
- Disruptive classroom behavior: <http://www.fresnostate.edu/academics/facultyaffairs/documents/apm/419.pdf>

University Services

- [Associated Students, Inc.](#)
- [Dream Success Center](#)
- [Learning Center Information](#)
- [Student Health and Counseling Center](#)
- [Writing Center](#)